

# **A Cross-Cultural Investigation of Social Motivation and Social Cognition in Young Children**

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The evolutionary success of our species is bound to our sociality—the tendency to engage in and benefit from social interactions. On a conceptual level, this sociality has been parsed into two facets, namely the proclivity to like and seek social interactions (social motivation) as well as the cognitive abilities needed to coordinate with others socially (social cognition).

While numerous studies have assessed social motivation and social cognition in young children, our current understanding of both facets is still far from conclusive. First, the exact ontogeny of social motivation and cognition remain largely unclear. Second, the degree to which either facet of sociality is shaped by cultural input remains poorly understood. Finally, interindividual variation in social motivation and cognition has yet to be examined, without which we can neither understand the construct validity of either facet, nor their potential interplay. In this dissertation, I present three studies addressing these issues by focusing on developmental, cross-cultural, and interindividual variation in three phenomena previously linked to sociality: Overimitation and collaboration as indicators of social motivation, as well as Theory of Mind as a proxy for social cognition.

In the first study I assessed whether children's overimitation would be shaped by age, culture, and the social presence of an adult model. I found that children across three diverse populations showed more overimitation with age and selectively in the presence of the model. I also documented cross-cultural variation in children's overimitation. On an individual level, children's overimitation did not predict their tendency to reengage a co-player in a collaborative activity.

In study 2, I found children's overimitation to vary systematically between two populations utilizing a procedure with reduced cognitive task demands. Here, age did not predict children's overimitation and variation across populations was only observed in how much, but not whether, children would overimitate.

In study 3, I documented systematic variation in children's social motivation for collaboration as well as their Theory of Mind across three populations and across the age range tested. On an individual level, indicators of social motivation were ontogenetically linked and predicted children's Theory of Mind.

In the general discussion, I propose an integrative model of social motivation and cognition to embed and expand the current findings. Accordingly, the interplay of socialization goals and practices, social motivation, and social cognition builds the foundation for children's social learning within social interactions.



# Summary

The ecological success of the human species is immense. Humans are one of the only species that has managed to occupy and transform almost every region across the globe. As a consequence, individuals need to be able to adapt to vastly different environments in order to survive. To do so, they rely on our species-specific propensity to use and refine information from others via social learning.

To explain the psychological mechanisms upon which the human propensity for social learning is built, scientists have suggested that *sociality*—our tendency to engage in and benefit from social interactions—is key (Levinson, 2006; Tomasello, 2014, 2016). On a conceptual level, human sociality has been argued to be rooted in a species-typical set of motivations and cognitive abilities facilitating social interactions. Childhood marks a critical period in the ontogeny of sociality given that young children are particularly reliant on social learning to become competent members of their society. Accordingly, the ontogeny of social motivation and social cognition in young children is crucial for our understanding of the foundations of human sociality.

Developmental psychologists have identified various phenomena that have been interpreted as early emerging indicators of sociality. Overimitation, or children's faithful imitation of others' actions regardless of their causal relevance, provides a powerful learning mechanism to acquire novel behaviors while facilitating affiliation with others. Their propensity to collaborate with others allows children to obtain resources they could never achieve by themselves. Their emerging skills to theorize

about the thoughts, beliefs, and desires of others help them to coordinate social interactions with high efficiency. The early ontogeny and pervasiveness of these phenomena across various scientific studies have led researchers to interpret sociality as a characteristic feature of our species' psychology, being deeply rooted in our genes and relatively unaffected by cultural input (Tomasello, 2014; Tomasello, Carpenter, Call, Behne, & Moll, 2005; Herrmann, Call, Hernández-Lloreda, Hare, & Tomasello, 2007; Levinson, 2006, 1995). Therefore, sociality has been hypothesized as a human universal that is expressed similarly across diverse social and environmental contexts. However, the evidence in support of such claims is strongly limited since the vast majority of developmental research assessing such phenomena comes from participants from Western, industrialized populations (Nielsen, Haun, Kärtner, & Legare, 2017). Whether such evidence also applies outside such contexts is currently unknown.

To address this shortcoming, this dissertation investigates the motivational and cognitive roots of sociality in children across diverse cultural contexts. As proxies for Western, urban-dwelling populations, I assessed children from Leipzig (Germany). German children are typically equipped with high levels of psychological autonomy in that the awareness and exploration of personal desires and beliefs is seen as a central socialization goal (Keller & Kärtner, 2013). At the same time, parents structure children's social learning through active scaffolding and child-centered pedagogy. In today's Western societies, childhood is typically perceived as a time of preparation, rather than active involvement (Morelli, Rogoff, & Angelillo, 2003), so that young children are typically not tasked with household chores or other responsibilities.

Hai||om children from Farm 6 and Ondera (Namibia) were investigated as their hunting and gathering subsistence style, including its social and psychological covariates, most closely resembles the circumstances under which humans have evolved. In accordance with other contemporary hunter-gatherer populations, the Hai||om emphasize children's autonomy from early on (Widlok, 1999; Terashima & Hewlett, 2016). Peer interactions provide an important opportunity for social learning among the Hai||om. These opportunities are, compared to Western pedagogy, less structured by adults but rather embedded in daily subsistence activities in which children are given the chance to participate and contribute (Lew-Levy, Reckin, Lavi, Cristóbal-Azkarate, & Ellis-Davies, 2017; Lew-Levy et al., 2019; Boyette & Hewlett, 2017; Hewlett & Roulette, 2016). Third, rural Ovambo children from Oshivelo (Namibia) were tested as proxies for small-scale farming populations in which socialization goals and practices typically highlight interpersonal relatedness and obedience (Zimba & Otaala, 1993; Zimba, 2002; Barry, Child, & Bacon, 1959). Among the Ovambo, learning opportunities are typically embedded in daily activities and child-centered pedagogy is given little emphasis as compared to Western, industrialized populations.

Importantly, culturally-specific socialization goals and practices in either of the three populations need to be perceived as evolved and specialized adaptations to the social and ecological conditions of each population. Cultural differences between the three populations should thus not be conceived as differences in quality or modernity.

For the purpose of this dissertation, I conducted three cross-cultural studies assessing social motivation in children's tendency to (over)imitate actions of an adult model (study 1 and study 2), their social motivation to collaborate with peers (study 1 and study 3), as well as their social-cognitive skills as indicated by their performance on a set of Theory of Mind tasks (study 3).

### ***Study 1 – Being observed increases overimitation in three diverse populations***

In the first study, I tested (a) whether an adult model's presence would increase children's overimitation across populations in a similar pattern, and (b) whether individual differences in children's overimitation would relate to a second proxy for social motivation, namely their reengagement of an interactant in a collaborative activity. In a within-subjects design, three- to eight-year-old children from the three populations (German, Hai||om, Ovambo) engaged in two overimitation scenarios. In one scenario, the adult model turned away from them after performing irrelevant actions on a puzzle box. Children were thus not observed when given the chance to overimitate (model-unobserving condition). In the other scenario, the model remained present and attentive when the participants were given the chance to act on the box (model-observing condition). In either condition, children's copying of causally irrelevant actions was coded as a proxy for overimitation. In the reengagement task, the model stopped contributing to a collaborative activity with the child (e.g., building a tower using wooden toy blocks). Children's subsequent behavior was then coded with regards to their active attempts to reengage the recalcitrant interactant to the activity.



Children across populations showed higher levels of overimitation in the model-observing condition as compared to the model-unobserving condition. Furthermore, children from either population showed more overimitation with increasing age. While these findings support the view that overimitation is a functionally universal phenomenon with recurrent developmental trajectories, children's persistence on overimitation varied across populations: German children copied irrelevant actions with more precision than both Hai||om and Ovambo children. Furthermore, German children showed more reengagement attempts than their Hai||om and Ovambo counterparts. On an individual level, however, children's overimitation did not predict their reengagement behaviors.

### ***Study 2 – Cultural variation in how much, but not whether, children overimitate***

To conceptually replicate and add to the findings of study 1, I assessed overimitation among Hai||om and German children using a modified overimitation task. Children between three and seven years of age were shown the retrieval of candy from four different boxes. In deviation from study 1, the experimenter introduced more familiar and simplistic boxes in order to reduce cognitive task demands on attention and memory.

As in the previous study, German children showed overimitation more persistently than their Hai||om counterparts. Interestingly, the rates of children showing no overimitation at all were similar in both populations. In either context, the majority of children showed overimitation at least once throughout the four tasks. In contrast to study 1, children's overimitation did not increase with age in this study.

### ***Study 3 – Collaboration and Theory of Mind in three diverse populations***

My objectives for study 3 were threefold: First, I wanted to assess potential effects of age and cultural context on children's social motivation to engage in peer collaboration. Second, I wanted to relate different components of social motivation in order to assess the construct validity of the phenomenon. Third, I wanted to examine potential ontogenetic links between social motivation and social cognition in order to shed light on the composition of children's sociality more broadly.

In a within-subjects design, three- to eight-year-old children played a game in which they could retrieve a reward either by engaging individually or through collaboration with a peer. After some trials, children were given the choice to decide themselves whether to play individually or in collaboration with their peer. As a first indicator of social motivation, children's positive emotional expressions throughout the first eight trials were coded and averaged separately for each condition. Children's forced-choice behaviors were assessed as a second proxy for social motivation. Children were additionally tested in a battery of Theory of Mind tasks to assess their social-cognitive skills.

Across ages and populations, children expressed more positive emotions during collaborative as compared to individual trials. This tendency was most pronounced among Germans, intermediate among Ovambo, and weakest among Hai||om children. In regards to their explicit choices, only German children across the age range showed a robust preference for collaboration. In contrast, Hai||om children preferred to play individually at all ages tested. In contrast, Ovambo children underwent a developmental shift in their preferences. While younger Ovambo robustly preferred

to collaborate, older children favored the individual option. With regard to the construct validity of social motivation, I found that children's positive emotional expressions during collaboration only predicted their forced-choice decisions at younger ages. With increasing age, the two components dissociated from one another. Finally, children's emotional expressions during collaboration predicted their Theory of Mind skills across cultural contexts.

Taken together, these results highlight both cultural variability and homogeneity in children's social motivation and social cognition. While the ontogeny of social motivation and cognition is strongly shaped by cultural context, some patterns appear cross-culturally recurrent. Both facets of sociality are rooted early in ontogeny and are consolidated within social interactions. Social motivation, social cognition, and culture work in parallel to shape the quality and quantity of social interactions—providing children with the learning opportunities they need to grow into fully-fledged members of their cultural group.



# Zusammenfassung

Der ökologische Erfolg der menschlichen Spezies ist außergewöhnlich. Kaum eine Spezies außer uns hat es geschafft, nahezu jede Region auf der Erde zu bewohnen und sie nach ihren Vorlieben zu gestalten. Eine Konsequenz dieser Expansion ist, dass sich Menschen in aller Welt an die unterschiedlichste Lebenswelten anpassen müssen. Um dies zu schaffen, ist das Lernen von anderen unabdinglich.

Um die psychologischen Mechanismen zu erklären, auf denen die menschliche Neigung für soziales Lernen fußt, haben Wissenschaftler vor allem unsere Sozialität hervorgehoben. Sozialität, definiert als die Tendenz soziale Interaktionen einzugehen und aus ihnen Nutzen zu ziehen, setzt sich demnach sowohl aus motivationalen, als auch aus kognitiven Dispositionen zusammen (Levinson, 2006; Tomasello, 2014, 2016). Die erst in ihrer Kombination spezifisch-menschliche Interaktionsformen ermöglichen. Der frühen Kindheit kommt dabei eine besondere Rolle zu, da die Wichtigkeit von sozialem Lernen insbesondere in dieser Phase zentral ist: Kinder müssen innerhalb kürzester Zeit alle essentiellen Informationen und Anforderungen ihrer Umwelt erlernen. Demnach kommt der frühkindlichen Entwicklung von sozialer Motivation und sozialer Kognition eine entscheidende Rolle für das Verständnis von menschlicher Sozialität zu.

Viele verschiedene Phänomene wurden bislang von Entwicklungspsychologen als frühe Indikatoren von Sozialität identifiziert. Überimitation, oder die Neigung, Verhaltensweisen anderer selbst dann zu imitieren, wenn diese keinerlei kausale Relevanz beinhalten, bietet einen wichtigen Lernmechanismus. So können bislang

unbekannte Verhaltensweisen erlernt werden, während das Verhalten auch die Möglichkeit zur Affiliation mit dem Modell schafft. Die kindliche Neigung zur Kollaboration erlaubt Kindern weiterhin den Zugang zu Ressourcen, die sie alleine nicht erreichen könnten. Die Fähigkeit zur mentalen Perspektivenübernahme (Theory of Mind), bei der die Gedanken und Wünsche anderer als solche verstanden und antizipiert werden, ermöglicht es Kindern weiterhin, soziale Interaktionen effizient zu gestalten und zu koordinieren.

Die frühe Entwicklung und die Durchgängigkeit dieser Phänomene in diversen Studien hat Wissenschaftler dazu verleitet, Sozialität als ein Charakteristikum der menschlichen Spezies zu verstehen, welches tief in unseren Genen verwurzelt und nur sehr eingeschränkt durch kulturellen Einfluss geprägt sei (Tomasello, 2014; Tomasello, Carpenter, Call, Behne, & Moll, 2005; Herrmann, Call, Hernández-Lloreda, Hare, & Tomasello, 2007; Levinson, 2006, 1995). Dementsprechend sei Sozialität universell und unter fast allen sozialen und ökologischen Bedingungen gleichermaßen zu beobachten. Empirische Evidenz zugunsten dieser Annahmen ist bislang jedoch stark limitiert, da die überwältigende Mehrheit an entwicklungspsychologischer Forschung zum Thema bislang lediglich Kinder aus westlichen, industrialisierten Populationen betrachtet hat (Nielsen et al., 2017). Ob solche Ergebnisse sich auch auf andere Kontexte übertragen lässt, ist folglich weitestgehend unerforscht.

Aus diesen Gründen behandelt diese Dissertation die motivationalen und kognitiven Ursprünge von menschlicher Sozialität in Kindern aus diversen kulturellen Kontexten. Kinder aus Leipzig (Deutschland) wurden als Stellvertreter für westliche,

urbane Lebenswelten erfasst. In Deutschland genießen Kinder üblicherweise eine hohe Menge an psychologischer Autonomie. Dies bedeutet, dass das Bewusstsein über persönliche Wünsche und Überzeugungen in der Kindeserziehung stark verwurzelt ist. Weiterhin sind in Deutschland Lernumgebungen stark durch Erwachsene strukturiert, die Kindern Hilfestellungen geben und gezielte, pädagogisch-aufbereitete Information bereitstellen (Keller & Kärtner, 2013). Wie in vielen westlichen Populationen wird Kindheit hier typischerweise als eine Zeit verstanden, in der Kinder auf das Erwachsenenleben vorbereitet werden, anstatt darin selbst aktiv teilzunehmen (Morelli et al., 2003). Dementsprechend sind heutzutage Kinder aus westlichen Gesellschaften nur selten in elementare Aufgaben zum Lebensunterhalt oder im Haushalt eingebunden oder verantwortlich.

Zudem wurden Hai||om-Kinder in Farm 6 und Ondera (Namibia) getestet. Ihre traditionelle Lebensweise als Jäger und Sammler, inklusive der typischen sozialen- und psychologischen Eigenheiten die typischerweise assoziiert mit dieser Lebensweise sind, charakterisieren die Hai||om als moderne Vertreter des Subsistenzsystems, welches die Spezies Mensch evolutionär am stärksten geprägt hat. Wie bei vielen anderen Jäger-Sammler-Kulturen genießt auch bei den Hai||om die Autonomie von Kindern eine enorme Wertschätzung (Widlok, 1999; Terashima & Hewlett, 2016). Für Hai||om-Kinder bieten Interaktionen mit Gleichaltrigen eine wichtige Umgebung zum sozialen Lernen. Im Vergleich zu westlichen Kulturen sind Lernumgebungen bei den Hai||om deutlich weniger aktiv von Eltern strukturiert oder vom Alltag separiert. Stattdessen lernen Kinder bevorzugt in alltäglichen Aktivitäten

und nehmen aktiv an diesen Teil (Lew-Levy et al., 2017, 2019; Boyette & Hewlett, 2017; Hewlett & Roulette, 2016).

Als dritte Population nahmen Ovambo-Kinder aus Oshivelo (Namibia) an zwei von drei Studien dieser Dissertation teil. Die Kultur der Ovambo ist stark geprägt durch ihre traditionelle Lebensweise als Kleinbauern. Dies beinhaltet typische Erziehungsziele und -praktiken bezüglich sozialer Beziehungen und Gehorsamkeit gegenüber Autoritäten (Zimba & Otaala, 1993; Zimba, 2002; Barry et al., 1959). Bei den Ovambo werden Lernmöglichkeiten für Kinder typischerweise in den Alltag integriert. Pädagogische Interventionen, die speziell auf den Lernerfolg von Kindern hinzielen, nehmen im Vergleich zu westlichen Erziehungspraktiken einen deutlich geringeren Stellenwert ein.

Ein wesentlicher Zusatz hierbei ist, dass die kulturspezifischen Sozialisationsziele und -praktiken in jeder der drei angeführten Populationen gleichermaßen als evolvierte und spezifische Adaptionen an die sozialen und ökologischen Bedingungen der jeweiligen Kultur zu verstehen sind. Kulturelle Abweichungen zwischen den Populationen sollten dementsprechend keinesfalls als Unterschiede bezüglich der Qualität oder Modernität der jeweiligen Populationen interpretiert werden.

Innerhalb dieser Dissertation stelle ich drei kulturvergleichende Studien vor, in denen ich die soziale Motivation von Kinder durch deren Tendenz zur Überimitation von erwachsenen Modellen (Studie 1 sowie Studie 2) sowie durch deren Bereitschaft für kollaborative Interaktionen mit Gleichaltrigen (Studie 3) operationalisiert habe.



Des Weiteren habe ich die sozial-kognitiven Fähigkeiten der Kinder durch eine Reihe von Theory of Mind-Aufgaben erfasst (Studie 3).

### ***Studie 1 – Beobachtung führt zu Überimitation in drei Populationen***

In der ersten Studie testete ich, ob (a) die Präsenz eines erwachsenen Modells das Auftreten von Überimitation bei Kindern aus verschiedenen Populationen gleichermaßen erhöhen würde, sowie ob (b) interindividuelle Unterschiede in Überimitation mit dem Re-engagement von Kollaborationspartnern zusammenhängt.

Innerhalb der Studie wurden drei- bis achtjährige Kinder aus den drei Populationen (Deutschland, Hai||om, Ovambo) in je zwei Versionen eines Überimitationsparadigmas getestet. In der ersten Version drehte sich das Modell vom Kind weg nachdem es die kausal irrelevanten Aktionen gezeigt hatte. Die Kinder wurden daher nicht beobachtet während sie die Aktionen selbst nachahmen konnten (Bedingung ohne Beobachtung). In einer anderen Bedingung blieb das Modell anwesend und zugewandt während das Kind Gelegenheit hatte, das Modell nachzuahmen (Bedingung mit Beobachtung). In der Re-engagement-Aufgabe interagierten Kind und Erwachsener zunächst in einer kollaborativen Aktivität (z.B., gemeinsames Bauen eines Holzturms). Plötzlich stoppte der Mitspieler während des Spiels, wonach hin die Versuche des Kindes zum Re-engagement des Mitspielers kodiert wurden.

Kinder aus allen Populationen zeigten gleichermaßen mehr Überimitation in der Bedingung mit-, als in der Bedingung ohne Beobachtung des Modells. Außerdem zeigten die Kinder mit wachsendem Alter mehr Überimitation. Während diese

Ergebnisse suggerieren, dass die soziale Funktion sowie die Entwicklungsverlauf von Überimitation möglicherweise universell sind, dokumentiert die erste Studie kulturübergreifende Differenzen in Überimitation: Deutsche Kinder zeigten mehr Überimitation als sowohl Hai||om- sowie Ovambo-Kinder. Gleichmaßen zeigten die deutschen Kinder auch mehr Re-engagement als die Hai||om und Ovambo, wobei beide Verhaltensweisen auf individueller Ebene nicht miteinander kovariierten.

### ***Studie 2 – Kulturelle Unterschiede in wie viel, aber nicht ob, Kinder überimitieren***

Um die Ergebnisse aus Studie 1 konzeptuell zu replizieren und zu ergänzen, erfasste ich in Studie 2 Überimitation bei Hai||om- sowie deutschen Kindern mit einem modifizierten Paradigma. In der Studie sahen drei- bis siebenjährige Kinder wie ein Modell Süßigkeiten nacheinander aus vier verschiedenen Kisten entnahm. Im Unterschied zu Studie 1 war das Modell ein einheimischer Erwachsener, der überdies dieses Mal deutlich einfachere und familiärere Behältnisse einführte um die kognitiven Anforderungen der Aufgabe bezüglich Aufmerksamkeit und Erinnerungsvermögen zu minimieren.

Auch in dieser Studie zeigten die deutschen Kinder mehr Überimitation als die Hai||om. Interessanterweise waren jedoch der Anteil der Kinder, die keinerlei Überimitation zeigten, bei beiden Populationen fast identisch: Die Mehrheit der Kinder in beiden Populationen zeigte Überimitation bei zumindest einer der vier Kisten. Im Unterschied zu Studie 1 zeigte sich in dieser Studie kein Alterseffekt auf Überimitation.

### ***Studie 3 – Kollaboration und Theory of Mind in drei diversen Populationen***

Für die nächste Studie waren drei Ziele maßgebend: Zunächst wollte ich ermitteln, ob und wie Alter und kultureller Kontext sich auf die kindliche soziale Motivation für Kollaboration mit Gleichaltrigen auswirken. Um die Konstruktvalidität von sozialer Motivation näher zu beleuchten wollte ich zudem herausfinden, ob verschiedene Komponenten dieser sozialen Motivation auf individueller Ebene zusammenhängen. Drittens wollte ich untersuchen, ob die Entwicklung von sozialer Motivation und sozialer Kognition auf individueller Ebene zusammenhängt, um die Struktur von Sozialität als solches zu erfassen.

In der Studie spielten drei- bis achtjährige Kinder ein Spiel, in dem sie Belohnungen sowohl alleine, als auch via Kollaboration mit gleichaltrigen Spielpartnern gewinnen konnten. Nach einigen Durchgängen durften die Kinder noch einmal wählen, ob sie alleine oder zusammen mit dem gleichaltrigen Kind agieren wollten. Als erster Indikator von sozialer Motivation wurde der positive emotionale Ausdruck der Kinder während der ersten acht Durchgänge kodiert und separat für jede Bedingung gemittelt. Die Präferenzen für oder gegen Kollaboration im finalen Durchgang dienten als zweiter Indikator für soziale Motivation. Außerdem wurden die Kinder mit einer Reihe von Theory of Mind-Aufgaben getestet, um ihre sozial-kognitiven Fertigkeiten zu ermitteln.

Kinder jeden Alters und über alle getesteten Populationen hinweg zeigten positivere Emotionen, wenn sie gemeinsam mit den Mitspielern spielten als wenn sie alleine agierten. Diese Tendenz war am stärksten ausgeprägt bei den deutschen Kindern und am schwächsten bei den Hai||om, während die Werte der Ovambo-Kinder

zwischen denen der anderen beiden Populationen lagen. Die deutsche Stichprobe war zudem die einzige, in der die Kinder mehrheitlich und über das gesamte Altersspektrum hinweg Kollaboration präferierten. Hai||om-Kinder jeden Alters zeigten dagegen eine Präferenz für die Solo-Option. Bei den Ovambo zeichnete sich ein Alterseffekt ab: Während jüngere Ovambo-Kinder Kollaboration präferierten, bevorzugten die älteren Kinder es, alleine zu agieren. Das Zeigen positiver Emotionen während Kollaboration konnte die Präferenzen der Kinder vorhersagen. Jedoch war dieser Zusammenhang nur bei jüngeren Kindern zu sehen, während beide Indikatoren von sozialer Motivation bei Kindern höheren Alters nicht kovariierten. Außerdem hingen auf individueller Ebene die positiven Emotionen im Kontext von Kollaboration mit der Performanz bei Theory of Mind-Aufgaben zusammen.

Zusammengefasst lässt sich sagen, dass diese Ergebnisse sowohl kulturelle Variabilität in sozialer Motivation und sozialer Kognition, als auch kulturübergreifende Gemeinsamkeiten bezüglich beider Facetten von Sozialität zeigen. Während die Entwicklung von Sozialität demnach stark durch Kultur geprägt ist, scheinen manche Muster durchaus universell. Die Grundlagen für Sozialität werden in der frühen Kindheit und innerhalb sozialer Interaktionen gelegt. Soziale Motivation, soziale Kognition und Kultur prägen gemeinsam die Qualität und Quantität frühkindlicher sozialer Interaktionen. Dieses Zusammenspiel erlaubt es Kindern, alle essentiellen Fähigkeiten zu erlernen, die sie auf ihrem Weg ins Erwachsenenalter benötigen werden.

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# 1

## Introduction

Compared to the physical, sensual, and even some cognitive abilities and capacities of other species, humans are not particularly impressive. Carnivores run, swim, or fly faster to catch their prey than we would ever be able to. Their sharp teeth and claws are deadly weapons, and they can digest a variety of food sources. Herbivores recognize olfactory and visual cues to track food from long distances. As a protection against predators, some of them grow big, run fast, and jump high. Others make use of shells, spikes, and poison to defend themselves. Some species can perceive sensations that we are not even aware of, such as ultrasonic echoes (e.g., bats), magnetism (e.g., birds), and pressure gradients (e.g., fish). Our nearest relatives, the chimpanzees, may even possess higher memory capacities (Inoue & Matsuzawa, 2007) and cognitive flexibility than we do (Pope, Fagot, Meguerditchian, Watzek, et al., 2019; but see Pope, Fagot, Meguerditchian, Washburn, & Hopkins, 2019).

In the light of these limitations and weaknesses, the ecological success of our species appears puzzling. Humans have managed to conquer and control the planet within just a few millennia of expansion. We divide the world up amongst ourselves, decide which species to rear and which to render extinct. It is needless to say that humans have developed extraordinarily abilities to do so—but which ones?

One prominent idea to explain what makes us so peculiar is our reliance on social learning: Like no other species, we modify and optimize our behaviors and

thoughts through social interaction with and observation of others (Boyd, Richerson, & Henrich, 2011; Boyd & Richerson, 1988; Henrich, 2015). Social learning helps us to circumvent the costs and risks of individual learning and allows us to rapidly adapt to almost any change in the environment. We do not need to run like cheetahs or gazelles in order to reach our destination on time—we have invented cars and bicycles generations ago and make use of these tools today. We do not need sharp teeth and claws to get sated—we invented guns, knives, and traps instead. We do not need to track fruit or vegetables in the wild—we cultivate them in gardens and fields or purchase them at the grocery store. It is not only “cold” cognition that enables our species’ ecological success. No individual could ever come up with all these skills and innovations just by herself (Henrich, 2015). We rely on learning from others—we share, use, refine, and rely on social information every day. Other animals may be experts in running and killing, but humans are experts in using, sharing, and accumulating information gained through social interactions. As such, our species’ success depends on the motivational and social-cognitive dispositions that set the stage for social interactions and social learning (Boyd et al., 2011; Henrich, 2015; Heyes, 2012; Tomasello, Kruger, & Ratner, 1993). Sociality, defined as the tendency to engage in and benefit from social interactions with others, constitutes what makes humans outliers when compared to other species.

Numerous psychological phenomena and behavioral dispositions have been discussed as manifestations of uniquely-human sociality: We form joint goals with others and pursue them through cooperative efforts (Alcalá, Rogoff, & López Fraire, 2018; Tomasello, 2019; Tomasello & Hamann, 2012). We understand and predict



others' behaviors based on their mental states and use this ability to coordinate our actions with them (Herrmann et al., 2007; Tomasello et al., 2005; Wellman, Cross, & Watson, 2001; Wimmer & Perner, 1983). We are not just social, but genuinely prosocial such that we care about others' needs and well-being (Hepach & Warneken, 2018; Warneken & Tomasello, 2006). We share information with others through communication (Astington & Baird, 2005; Liszkowski, Carpenter, & Tomasello, 2008; Sperber et al., 2010) and anticipate if information can be taken for granted or if we should be skeptical instead (Koenig & Harris, 2005; Harris & Corriveau, 2011; Mascaro & Sperber, 2009; Sperber et al., 2010). We build long-lasting relationships (Engelmann & Rapp, 2018; Over, 2016) and are loyal to people with whom we are affiliated with (Misch, Over, & Carpenter, 2016). We adhere to social norms (Rakoczy & Schmidt, 2013; Rakoczy, Warneken, & Tomasello, 2008) and conform to the behaviors of those around us (Asch, 1956; Bond & Smith, 1996; Haun & Tomasello, 2011).

To fully understand human sociality, it is not sufficient to consider each of these phenomena independently. Instead, it is important to assess whether they are rooted in similar motivations and cognitive abilities that, on a conceptual level, form the foundations of sociality. To fully understand the conceptual homogeneity of these phenomena, the combination of comparative, developmental, and cross-cultural perspectives presents a promising avenue (Liebal & Haun, 2018; Nielsen & Haun, 2016). Furthermore, doing so allows to balance the limitations while utilizing the strengths of each perspective in parallel.

Comparative perspectives are of interest because they help us to gather insights on whether and how human psychology differs from that of other species. Doing so is

inevitable for understanding the evolutionary roots of our psychology and behavior (Liebal & Haun, 2012; MacLean et al., 2012; Rosati & Warneken, 2016; Whiten & Watson, 2018). Sociality has been ascribed the role of a fundamental fitness trait among primates in general (Amici & Widdig, 2019), as it can generate benefits for the survival of each individual by mutual cooperation. Comparative perspectives on chimpanzees (*Pan troglodytes*) and bonobos (*Pan paniscus*) are of particular interest given that these species are our nearest relatives among the great ape lineage. In this dissertation, I will mainly focus on the differences and commonalities between humans and chimpanzees since comparative research on bonobos is far from comprehensive. Whenever such information is available, I will also summarize evidence on sociality among bonobos.

One central differences between humans and other primate species is that human ontogeny is characterized by an extraordinarily prolonged period of time in which, before reaching sexual maturity, young individuals are still taken care of by their social group—childhood (Bogin & Smith, 1996). The adaptive value of childhood is that it allows children to develop and acquire an immense amount of skills and behaviors that will later be needed in their adult lives (Bogin, 1997; Kuzawa et al., 2014). Second, I will thus focus on how human psychology develops throughout childhood. Developmental approaches provide us with valuable information on this period by describing how physical maturation and socio-cultural input together shape human behaviors (Bjorklund, 2018; Bjorklund & Blasi, 2015; Legare, 2017; Legare, Clegg, & Wen, 2018; Liebal & Haun, 2018). Given that the vast majority of developmental research stems from investigations of participants from Western,

industrialized populations (Nielsen et al., 2017), I will first focus on evidence gained from such populations when discussing the ontogeny of sociality in children.

To balance out this shortcoming while introducing a third perspective on sociality, I will then describe cross-cultural evidence on whether and how young children's sociality varies systematically across populations. The ecological and social environments in which children grow up are extremely diverse. Instead of merely adopting our genes to those circumstances, we depend on cultural input from early on. As a consequence, human psychology and behavior varies systematically across individuals and populations, rendering generalizations outside the investigated populations insufficient, if not inadequate (Henrich, 2015). The examination of the differences and similarities of cultural contexts is essential for creating valid and generalizable conclusions about human psychology (Henrich, Heine, & Norenzayan, 2010; Jones, 2010; Rad, Martingano, & Ginges, 2018). Only recently have researchers started to systematically assess whether the ontogeny of sociality follows comparable trajectories across human populations (Nielsen & Haun, 2016; Amici & Widdig, 2019; but see Madsen, 1971).

Describing cultural heterogeneity in human psychology is not just important to account for variation in psychology and behavior. Variation is not some unsystematic noise that needs to be controlled for by applying methodological rigor or testing larger samples. Instead, culture itself is a defining characteristic of our species and the result of evolutionary processes (Henrich, 2015; Heyes, 2019). It is thus not just the detection of universal or variable patterns in psychology and behavior that

is needed for a comprehensive understanding of what defines our species, but also the assessment of how culture interacts with how we think, perceive, and behave.

Importantly, neither of these approaches fully captures the peculiarities of human sociality. A combination of comparative, developmental, and cross-cultural perspectives is needed to fully understand the motivations and skills enabling social interactions (Liebal & Haun, 2012, 2018; Nielsen & Haun, 2016; Nielsen et al., 2017).

In the following sections, I will focus on three phenomena that have previously been discussed as hallmarks of human sociality. First, I will discuss the role of imitation on shaping social interactions (Heyes, 2016; Legare & Nielsen, 2015; Meltzoff, 1988; Nielsen, 2012; Tomasello et al., 1993). In particular, I will focus on the exact imitation of visibly irrelevant behaviors, a tendency which has been coined overimitation (Lyons, Young, & Keil, 2007; see also Horner & Whiten, 2005; Hoehl et al., 2019). Second, I will discuss the role of cooperation and collaboration in human psychology (Melis & Semmann, 2010; Melis & Warneken, 2016; Tomasello, 2009). While cooperation refers to all behaviors that aim to benefit others (Melis & Semmann, 2010), those actions in which two or more individuals jointly work toward a shared goal will henceforth be labelled collaboration (Tomasello & Hamann, 2012). Collaboration is especially relevant for the purpose of this dissertation as it requires social partners to voluntarily share their attentional focus, which has previously been interpreted as a hallmark of human sociality (Tomasello et al., 2005). Third, I will focus on our understanding of others as mental agents who act in accordance to their beliefs, desires, and emotions. This Theory of Mind (Premack & Woodruff, 1978) has long been described as a defining trait of our species (see also Call & Tomasello, 2008).

For each phenomenon, I will first describe its significance in scientific debates in both evolutionary psychology and anthropology. Second, I will summarize current knowledge from comparative psychology on whether and how humans differ from non-human great apes regarding the respective phenomenon. Third, I will discuss how each phenomenon emerges throughout early ontogeny and how it relates to other developmental milestones both concurrently and longitudinally. Next, I will describe evidence on cross-cultural variability and homogeneity regarding each phenomenon. In the remaining chapters of this introduction, I will then discuss possible links between overimitation, collaboration, and Theory of Mind, before drawing conclusions on the motivational and cognitive underpinnings of the three phenomena.

## **Overimitation**

Imitation, defined as the exact copying of others' behaviors, is ubiquitous in human social learning. Engaging in imitation allows individuals to avoid the costs and dangers of trial-and-error learning or innovation. Instead, copying a model enables the imitator to directly benefit from others' skills. Imitation has been ascribed a central role in the accumulation of cultural knowledge (Legare & Nielsen, 2015; Whiten, 2019). Our proclivity to imitate others in order to learn about the world becomes obvious when looking at our tendency to overimitate others by copying even actions that are clearly causally irrelevant (Lyons et al., 2007; see also Horner & Whiten, 2005). Overimitation has been hypothesized as a particularly important mechanism for human-unique forms of social learning, which is why the focus of this

dissertation will primarily be on the ontogeny of overimitation. Since overimitation can be considered a special case of imitation due to its reliance on exact copying, I will mention studies on imitation whenever corresponding conclusions can apply to overimitation as well. Overimitation stands in opposition to emulation, which is defined as the copying of the outcome (as opposed to the means) of others' goal-directed actions (Horner & Whiten, 2005; Whiten, McGuigan, Marshall-Pescini, & Hopper, 2009).

In the large repertoire of social learning strategies that humans possess, imitation is arguably the most puzzling one. At first glance, copying others' actions may fall behind other social learning strategies with regards to efficiency. Yet, it can serve as a powerful function to acquire complex skills (Heyes, 2012a, 2013, 2016; Legare & Nielsen, 2015) and may thus support the accumulation of cultural information with small error rates. A behavioral tendency to overimitate has thus the potential to boost social learning of culturally-specific but functionally opaque behaviors (e.g., rituals and conventions), which may guarantee the transmission of such information within and across generations.

In addition, imitation (and overimitation in particular) can serve a social function between individuals and has thus been discussed as a “social glue” of cultural learning (Nielsen, 2018; see also Užgiris, 1981; Legare & Nielsen, 2015; Over & Carpenter, 2013). The exact imitation of even causally irrelevant actions can present a communicative signal to display affiliation with the model. Overimitation is thus not only a mechanism for social learning, but also a tool for establishing and maintaining social interactions.

### ***Overimitation Across Species***

There has been a long debate on whether and how chimpanzees learn through imitation. Some studies have identified imitation of facial movements in neonatal chimpanzees (Bard, 2007; Myowa-Yamakoshi, Tomonaga, Tanaka, & Matsuzawa, 2004). Together with documentations of imitation among both wild (Hobaiter & Byrne, 2010) and human-raised chimpanzees (Buttelmann, Carpenter, Call, & Tomasello, 2007; Horner & Whiten, 2005), these observations suggest that imitation may be an innate mechanism with deep phylogenetic roots. However, when being confronted with novel behaviors, it appears that imitation is only one amongst several strategies of social learning that chimpanzees use and that emulation is typically preferred when choosing how to learn from others (Call, Carpenter, & Tomasello, 2005; Tennie, Call, & Tomasello, 2006). With regard to overimitation, current evidence suggests that neither chimpanzees (Horner & Whiten, 2005) nor bonobos (Clay & Tennie, 2018) imitate causally irrelevant actions as soon as they are aware of more efficient means to reach a goal.

### ***The Ontogeny of Overimitation***

The foundations for (over)imitation are laid early in human ontogeny. Some researchers have even argued that children are born with an innate instinct to imitate others' actions (Meltzoff, 1988; Meltzoff et al., 2018). However, this assumption has been challenged by studies failing to replicate such findings in larger samples (Oostenbroek et al., 2016; see also Heyes, 2016) or failing to find long-term consequences of interindividual variation in neonatal imitation (Redshaw et al., 2019). Others found parenting practices to predict imitative behaviors among one-year-old

infants, suggesting that the behavior responds to social input from early on (de Klerk, Lamy-Yang, & Southgate, 2019). Regardless of whether scientists hypothesize imitation to be innate or learned socially, there is an overarching consensus among developmental psychologists with regard to the pervasiveness and importance of imitation for social learning in early childhood (Heyes, 2012a; Legare & Nielsen, 2015).

The developmental onset of overimitation is located around children's second year of life (Nielsen, 2006). From this age onwards, the behavior becomes more frequent well into adulthood (McGuigan, Makinson, & Whiten, 2011; Whiten, Allan, et al., 2016), while interindividual differences in overimitation appear developmentally stable and robust (Yu & Kushnir, 2019). Given the absence of overimitation among chimpanzees and bonobos, its potential role in human ontogeny has been discussed intensively. Overimitation may serve the transmission and manifestation of group-specific behaviors, such as rituals and other conventions (Nielsen & Tomaselli, 2010; Whiten, McGuigan, Marshall-Pescini, & Hopper, 2009; Whiten, Caldwell, & Mesoudi, 2016). As a consequence, overimitation has been ascribed an important function in our propensity to accumulate cultural knowledge across generations (Heyes, 2012a; Legare & Nielsen, 2015; Nielsen, 2018).

Given that children are unlikely to be aware of these implications, the question arises why children show overimitation even in situations in which emulation would be more efficient. Two main accounts have been put forward to explain the early occurrence of overimitation in young children. First, overimitation may be a mere by-product of children's lack of causal understanding necessary to determine and skip



irrelevant actions. According to this *cognitive account* (Lyons et al., 2007), overimitation is a manifestation of a human-specific tendency to perceive intentionally communicated information as causally relevant (see also Csibra & Gergely, 2009).

A second account emphasizes the social function of overimitation as an affiliative signal in interpersonal contexts. This *social account* (Nielsen, 2008; Over & Carpenter, 2012, 2013) assumes a specific motivation to interact and affiliate with others as a driving force behind overimitation. Overimitation allows individuals to display affiliation and similarity to the model. In support of this account, children imitate others' actions more precisely in the presence of the model (Marsh, Ropar, & Hamilton, 2014; Nielsen & Blank, 2011) and after being primed with social exclusion (Over & Carpenter, 2009; Watson-Jones, Whitehouse, & Legare, 2016).

Importantly, the two accounts do not stand in strict opposition to each other. Instead, it is most plausible that a combination of both social and cognitive factors constitutes whether and how much children overimitate (Over & Carpenter, 2012, 2013; Schlehauf, Graetz, Pauen, & Hoehl, 2017). However, recent research suggests that the social function of overimitation becomes increasingly important with age (Clay, Over, & Tennie, 2018; Gellén & Buttelmann, 2019).

### ***Overimitation Across Cultures***

Given that imitation has been interpreted as a driver of the accumulation of cultural information, it is not surprising that this form of social learning has been discussed with regards to its ontogeny across populations (Legare, 2017; Legare & Nielsen, 2015). Among Aka hunter-gatherer children from central Africa, imitation is

particularly important for acquiring novel skills in children's first years of life (Salali et al., 2019). Up from middle childhood, Aka children predominantly learn from peers through play. While these results highlight ontogenetic variation in children's tendency to imitate others, they also highlight the importance of imitation as a cross-culturally recurrent driver of social learning in young children (Hewlett, Fouts, Boyette, & Hewlett, 2011; Terashima & Hewlett, 2016).

To which extent the same applies for the development of overimitation is much more controversial (Berl & Hewlett, 2015; Clegg & Legare, 2016; DiYanni, Corriveau, Kurkul, Nasrini, & Nini, 2015; Nielsen, Mushin, Tomaselli, & Whiten, 2014, 2016; Nielsen & Tomaselli, 2010). Nielsen and Tomaselli (2010) documented comparable levels of overimitation among urban Australian children and children from recent hunter-gatherer populations in South Africa, the Khwe and the !Xun/!Kung. Further studies replicated and extended these findings, documenting comparable levels of overimitation among children from Australian aboriginal communities as well as other non-Western, traditional populations (Nielsen et al., 2014, 2016; Nielsen, Tomaselli, & Kapitány, 2018). A key message to conclude from these studies is that the function of overimitation is that of a "social glue" that contributes to social learning of cultural, ritual-like behaviors across a wide range of cultural contexts (Nielsen, 2018; see also Legare & Nielsen, 2015; Nielsen & Haun, 2016; Nielsen & Tomaselli, 2010).

Claims on the universality of overimitation have only been challenged recently by studies documenting systematic variation in overimitation across populations. Berl and Hewlett (2015) found almost no overimitation among Aka hunter-gatherer

children from the Central African Republic. Their behaviors differed strongly from those of neighboring horticulturalist children who overimitated an adult model with much higher fidelity. In contrast to Aka children, Aka adults overimitated the model at much higher rates. While documenting that overimitation is within the behavioral repertoire of the Aka, this study was the first to report cross-cultural variability in the early ontogeny of overimitation.

Clegg and Legare (2016) were among the first to study how social contexts affect overimitation in diverse populations. In their study, children from urban U.S. and Ni-Van children from rural Tanna (Vanuatu) observed an adult modelling actions by either framing these normatively (e.g., using normative instructions referring to group norms) or instrumentally (e.g., highlighting the instrumental goal of one's actions). In the normative condition, children from both populations showed high rates of overimitation. When the imitation task was framed instrumentally, however, Ni-Van children imitated at higher rates than their U.S. counterparts. The researchers explain this finding with reference to conformist values that are emphasized in Ni-Van socialization goals. Therefore, these children may have perceived the instrumental instruction as a normative request for imitation, whereas the same framing may have led children from the more independent U.S. to skip irrelevant actions.

In another study, DiYanni and colleagues (2015) confronted children from either European-American or Chinese-American backgrounds with two versions of an overimitation task. While children from both groups imitated at comparable rates when the actions were modelled by one single adult, the two populations diverged

when being confronted with a group of multiple adult models. In the latter scenario, Chinese-American children were more likely to overimitate than their European-American counterparts. DiYanni and her colleagues explained this effect with regard to the cultural emphasis on conformity and obedience among Chinese-American participants. The emphasis on independency and autonomy among the European-Americans may, in contrast, have led to lower overimitation in this condition.

Critically, the psychological mechanisms underlying cross-cultural variation in children's overimitation are still discussed. Cognitive accounts may explain this variation with reference to cultural differences in children's capacity to differentiate between irrelevant and relevant actions. However, two findings challenge this hypothesis: First, after observing a model manipulating toys, 18-month-olds' from urban Germany imitate more actions than same-aged infants from rural Cameroon, even if these actions are functional (Borchert, Lamm, Graf, & Knopf, 2013). It is thus unlikely that the lower levels of imitation outside Western contexts stem from a better causal understanding in those communities. Second, the occurrence of overimitation among Aka adults, but not children, indicates that cognitive maturation leads to higher, rather than lower rates of overimitation (Berl & Hewlett, 2015).

Instead, it seems more plausible that the social context in which overimitation is typically assessed selectively facilitates the use of overimitation among children from Western populations and those from cultural contexts emphasizing obedience and conformity. In Western contexts, dyadic and child-centered pedagogy is commonly used to scaffold social learning. Western children learn that overimitation results in positive outcomes, such as affiliation and praise by adults. In populations

emphasizing obedience and conformity, overimitation may be used to display similarity and respect to the model while avoiding innovations. In populations in which children's autonomy in social learning is more emphasized, their reliance on overimitation may be markedly lower due to a more flexible selection of social learning strategies (Berl & Hewlett, 2015).

In sum, overimitation appears to be a pervasive strategy for social learning that is rooted early in ontogeny and increases with age. Even though chimpanzees and bonobos share the cognitive capacities needed for imitation, they do so only if there is no easier solution available. Evidence from cross-cultural studies highlights the importance of culture on shaping if, at which age, and under which conditions children overimitate. An interplay of cultural emphasizes on obedience, autonomy, and direct pedagogy may affect the emergence of and reliance on overimitation in young children.

## **Collaboration**

While overimitation provides us with a useful mechanism for social learning, collaboration has also been identified as a key constituent of the acquisition and transmission of cultural information (Tomasello, 2016). Our propensity to cooperate and collaborate with others enables us to create payoffs we could never attain individually. Collaboration is so ubiquitous among humans that it has often been considered a universal cornerstone of sociality (Apicella & Silk, 2019; McLoone & Smead, 2014; Melis & Semmann, 2010; Melis & Warneken, 2016; Tomasello, 2009; Tomasello & Hamann, 2012).

With collaboration, I will henceforth refer to social interactions in which two or more partners work jointly and interdependently toward a shared goal. Collaboration can thus be considered a special case of cooperation, which is broadly defined as all behaviors aiming to benefit others (Melis & Semmann, 2010). The focus of this dissertation will primarily be on collaboration because of the necessity to coordinate actions with collaborative partners both behaviorally and psychologically. I will, however, also include evidence based on studies assessing cooperation whenever such information adds to our understanding of collaboration.

### ***Collaboration Across Species***

The evolutionary roots of cooperation and collaboration dig deep. A wide range of species, including elephants (Plotnik, Lair, Suphachoksahakun, & de Waal, 2011), spotted hyenas (Drea & Carter, 2009), dolphins (Kuczaj, Winship, & Eskelinen, 2015), and keas (Heaney, Gray, & Taylor, 2017), are capable of collaborating with conspecifics under experimental conditions (see also Pitman & Durban, 2012, for observational evidence on collaborative hunting techniques in killer whales). It is thus not surprising that collaboration has also been observed among non-human great apes (Bullinger, Melis, & Tomasello, 2011; Hirata & Fuwa, 2007; Rekers, Haun, & Tomasello, 2011; Rosati, DiNicola, & Buckholtz, 2018). Wild living chimpanzees engage in collaborative hunting to chase prey (Boesch & Boesch, 1989) and they build coalitions to defend themselves against aggressors (Newton-Fisher, 2006). Experimental studies have revealed that chimpanzees also collaborate with conspecifics in controlled, lab-based setups (Bullinger et al., 2011; Hirata & Fuwa, 2007; Rekers et al., 2011). Chimpanzees recruit and invest in collaborators depending on the necessity of collaboration for

obtaining a reward and based on whether the collaborator is capable of fulfilling his or her role in the joint enterprise (Melis, Hare, & Tomasello, 2006).

It is thus without much doubt that our nearest relatives are capable of collaboration. However, chimpanzee's collaboration is fragile. For example, low levels of social tolerance among chimpanzees can impede collaboration, especially with regard to hierarchy-based conflicts between conspecifics (Hare, Melis, Woods, Hastings, & Wrangham, 2007; Melis, Hare, & Tomasello, 2006). Interestingly, bonobos perform better (though not at ceiling) in such tasks due to their heightened social tolerance and egalitarian group structures (Hare et al., 2007). In line with these findings, interindividual differences in chimpanzees' social tolerance predict whether they are able to establish mutual cooperation with social partners (Melis et al., 2006). Interestingly, chimpanzees are more likely to collaborate with conspecifics if doing so leads to higher yields for both contributors (Bullinger et al., 2011; Rekers et al., 2011). Without fair payoffs being ensured for either interactant, dominant individuals typically start monopolizing the spoils instead of sharing them with their collaborative partner (John, Duguid, Tomasello, & Melis, 2019). As a consequence, the collaborative partner typically loses interest and the collaborative activity is not continued (Melis et al., 2006).

In sum, it appears that the cognitive foundations for collaboration are present among both chimpanzees and bonobos. However, collaboration is fragile and restricted by situational constraints, such as whether resources can be monopolized or whether collaborators are socially tolerant with one another.

### ***The Ontogeny of Collaboration***

Children start to engage in collaborative interactions with adults between their first and second year of life (Warneken, Chen, & Tomasello, 2006). At this age, collaborative activities are often structured and supervised by adult caregivers. With increasing age, children become more autonomous in their collaborative activities. Up from their second year of life, children are capable of engaging in dyadic collaboration with peers without external supervision (Brownell, Ramani, & Zerwas, 2006). From now on, they start forming joint commitments, coordinate actions, and switch roles flexibly to guarantee stable and beneficial instances of collaboration with both peers and adults (Tomasello et al., 2005; Tomasello & Hamann, 2012).

This evidence illustrates that the cognitive milestones necessary for collaboration are already present at around two to three years of age. Importantly, children are also motivated to engage in collaborative activities from early on. When an adult stops participating in a reciprocal task, 18-months-olds wait and try to reengage their interactant until the joint activity is continued (Warneken et al., 2006). Notably, such reengagement behaviors occur regardless of whether children could principally complete the task at hand with or without the support of their co-player (Gräfenhain, Behne, Carpenter, & Tomasello, 2009; Warneken, Gräfenhain, & Tomasello, 2012).

Peer collaboration seems to be rewarding as well: When given the choice to obtain a reward either alone or together with a peer, three-year-old children prefer to collaborate (Rekers et al., 2011). Even the mere opportunity to collaborate with a peer



increases children's persistence in and liking of tasks (Butler & Walton, 2013; Master, Butler, & Walton, 2017).

### ***Collaboration Across Cultures***

Cross-cultural evidence on children's collaboration is sparse. Some studies suggest that children from diverse populations are capable and motivated to collaborate with both adults (Callaghan et al., 2011) and peers (Alcalá et al., 2018; Corbit, McAuliffe, Callaghan, Blake, & Warneken, 2017; Correa-Chávez & Rogoff, 2009; Mejía-Arauz, Rogoff, Dexter, & Najafi, 2007). However, this does not mean that their tendency to collaborate is not shaped by cultural context. In a classic study, dyads of urban U.S. children showed difficulties to agree on collaborative strategies in order to solve a social dilemma with their interactant. Rural Mexican children, in contrast, were better at finding collaborative strategies to solve the dilemma for mutual benefit (Madsen, 1971; see also Mejía-Arauz et al., 2007). It thus seems that culture "impact[s] the degree of collaborative tendencies, but not their presence" (Slocombe & Seed, 2019, p. R473).

In sum, the foundations for children's collaboration with peers and adults are laid early in ontogeny. In Western populations, collaboration first emerges under adult supervision. Even though the ontogeny of collaboration among non-Western populations remains largely unknown, some studies indicate that culture may shape children's tendency to choose collaboration over other strategies to solve challenges they encounter.

## **Theory of Mind**

Given the ubiquity of social interactions across human societies, understanding and predicting the behaviors of social partners can be of utmost value. A powerful tool in this regard is to ascribe the same cognitive, motivational, and emotional processes that guide our own behaviors to others. This Theory of Mind (Premack & Woodruff, 1978) is crucial for almost any aspect of social interactions and social functioning. It allows us to predict others' behaviors and to coordinate with them efficiently (Grueneisen, Wyman, & Tomasello, 2015). Theory of Mind supports the acquisition of language (Astington, 2006; Milligan, Astington, & Dack, 2007) and is an ontogenetic driver of moral reasoning based on intentions (Lane, Wellman, Olson, LaBounty, & Kerr, 2010). It is a central constituent of cultural learning (Tomasello et al., 1993), selective trust (Brosseau-Liard, Penney, & Poulin-Dubois, 2015; DiYanni et al., 2012; Sabbagh & Baldwin, 2001; Vanderbilt, Liu, & Heyman, 2011) and deceptive communication (Ding, Wellman, Wang, Fu, & Lee, 2015). Thus, Theory of Mind is ubiquitous in almost any aspect of social interactions.

### ***Theory of Mind Across Species***

Premack and Woodruff (1978) asked the seminal question whether chimpanzees would understand their conspecifics by utilizing a Theory of Mind. Since then, this question has led to numerous studies investigating the social-cognitive abilities of humans and other species, including non-human great apes (see Call & Tomasello, 2008; Krupenye & Call, 2019, for reviews). Initially, comparative studies yielded little evidence for such skills outside the *Homo* lineage (Call & Tomasello, 1999; Krachun,

Carpenter, Call, & Tomasello, 2009). Chimpanzees seem to lack the social-cognitive skills needed to theorize about the mental states of others (Herrmann et al., 2007).

However, recent research has challenged these findings. Chimpanzees understand the goals and intentions underlying their conspecifics' behaviors (Buttelmann et al., 2007; Myowa-Yamakoshi & Matsuzawa, 2000). They are able to consider others' knowledge states in order to either coordinate with them (Grueneisen, Duguid, Saur, & Tomasello, 2017) or to deceive them (Hare, Call, & Tomasello, 2006). According to a recent study, chimpanzees may even be capable of using (implicit) false-belief reasoning to predict others' behaviors (Krupenye, Kano, Hirata, Call, & Tomasello, 2016; Buttelmann, Buttelmann, Carpenter, Call, & Tomasello, 2017; but see Call & Tomasello, 1999; Krachun, Carpenter, Call, & Tomasello, 2009).

One potential cause of the inconsistent evidence regarding Theory of Mind in chimpanzees concerns the social context in which the phenomenon is typically assessed. Competitive contexts have been argued to be more ecologically valid for assessing Theory of Mind in chimpanzees given that social interactions with conspecifics typically imply competition about resources (Grueneisen et al., 2017; Lyons & Santos, 2006). If so, chimpanzees may be more motivated to mentalize selectively during competitive interactions, whereas they may be less inclined to do so during cooperative endeavors.

### ***The Ontogeny of Theory of Mind***

Young children's Theory of Mind emerges within social interactions (Carpendale & Lewis, 2004), leading to distinct developmental trajectories in the acquisition of

Theory of Mind (Wellman & Liu, 2004). In their first year of life, infants already understand that agents act based on their personal goals (Woodward, 1998). During their second year of life, toddlers consider common ground and shared experiences in interpreting others' behaviors (Moll & Kadipasaoglu, 2013; Moll & Tomasello, 2007). At the same age, they are able to engage in visual perspective taking (Sodian, Thoermer, & Metz, 2007) and understand that others have desires that may differ from their own ones (Repacholi & Gopnik, 1997). Until five years of age, they typically master other social-cognitive milestones, such as understanding that others may have different beliefs than themselves, that knowledge depends on access to information, and that others act according to the beliefs they have about the world even though these beliefs may be objectively false (Wellman et al., 2001; Wellman & Liu, 2004). Between five to seven years of age, they start to understand deception (Mascaro & Sperber, 2009; Stengelin, Grueneisen, & Tomasello, 2018) and make use of higher-order, recursive mindreading skills (Grueneisen et al., 2015; Miller, 2009).

From infancy to late childhood, Theory of Mind undergoes a constant refinement. Recent research, however, has raised doubt on the importance of ontogeny in shaping young children's Theory of Mind. Building upon novel paradigms, some researchers have pointed out that the fundamental abilities of mindreading are already evident during infancy, suggesting an early emerging and potentially innate understanding of others' behaviors based on implicit mentalistic reasoning (Buttelmann, Carpenter, & Tomasello, 2009; Scott & Baillargeon, 2009; Scott, Baillargeon, Song, & Leslie, 2010; Southgate, Chevallier, & Csibra, 2010; see Baillargeon, Scott, & He, 2010; for a review). However, theories claiming such an

innate predisposition for Theory of Mind have been challenged both theoretically and empirically. First, failed replication attempts have taken the existence of such implicit mindreading abilities beyond publication biases into question (Poulin-Dubois et al., 2018; Sabbagh & Paulus, 2018). Second, claims on the existence of mindreading skills in infants do not prove that such abilities are necessarily innate. Both cross-sectional and longitudinal studies have shown that Theory of Mind does not emerge in isolation. For example, attending to and engaging in social interactions facilitate children's reasoning in both implicit false-belief tasks (Burnside, Wright, & Poulin-Dubois, 2018; Roby & Scott, 2016) as well as in explicit tasks on false belief and other indicators of Theory of Mind (Carpendale & Lewis, 2004; Charman et al., 2000; Nelson, Adamson, & Bakeman, 2008). Parental interaction styles and conversations about mental states have been shown to precede and shape children's Theory of Mind at later ages (Taumoepeau & Ruffman, 2006).

Theory of Mind shows developmental continuity in that certain milestones precede others at later ages. For example, attention to goal directed action in infants predicts their mastery of explicit false-belief tasks at later ages (Aschersleben, Hofer, & Jovanovic, 2008; Brink, Lane, & Wellman, 2015). The same applies to children's ability to understand others' visual perspectives, which precedes the explicit understanding of false-beliefs at four years of age (Yeung, Müller, & Carpendale, 2019).

Regardless of whether some abilities linked to Theory of Mind are innate or not, there is not much doubt that social experience plays a central role in the ontogeny of

Theory of Mind. Like any other theory, Theory of Mind requires data-driven validation and is thus necessarily founded within social interactions.

### ***Theory of Mind Across Cultures***

In line with this overwhelming evidence for the emergence of Theory of Mind in children from Western, industrialized populations, some studies yielded little variation in Theory of Mind across populations (Avis & Harris, 1991; Barrett et al., 2013; Liu, Wellman, Tardif, & Sabbagh, 2008; Wellman et al., 2001; Wellman & Liu, 2004; Wimmer & Perner, 1983). However, recent studies have challenged this perspective markedly.

First, researchers have documented that even though some skills linked to Theory of Mind may be culturally recurrent, the developmental onsets and trajectories of these skills may differ across cultural contexts (Kuntoro, Saraswati, Peterson, & Slaughter, 2013; Liu et al., 2008; Shahaeian, 2015; Shahaeian, Nielsen, Peterson, Aboutalebi, & Slaughter, 2014; Shahaeian, Peterson, Slaughter, & Wellman, 2011). Others have highlighted even more substantial variation regarding children's Theory of Mind (Dixson, Komugabe-Dixson, Dixson, & Low, 2017; Mayer & Träuble, 2015, 2013). In the pacific archipelago of Samoa, for example, children hardly pass false-belief tasks until they reach ten years of age (Mayer & Träuble, 2015, 2013). Accordingly, it appears that the ontogeny of Theory of Mind relies on whether or not such reasoning is considered appropriate and on the degree to which mental states are considered the major determinants of behavior (as opposed to, for example, faith; Dixson et al., 2017; McNamara, Willard, Norenzayan, & Henrich, 2019).

In sum, children across a broad range of cultural contexts develop a thorough understanding of others' minds throughout middle childhood. This does not mean that the ontogeny of Theory of Mind is not shaped by cultural input. Instead, children (and chimpanzees) learn to understand and predict others' thoughts and behaviors gradually and mediated by social interactions. Given the importance of culture on shaping the quality and quantity of young children's social interactions (Keller, 2007; Rogoff, 2003), the cultural nature of Theory of Mind becomes ever more evident.

## **Shared Roots of Sociality**

Taken together, evidence gained from comparative, developmental, and cross-cultural psychology suggests that neither are children "ultra-social" (Tomasello, 2014) from birth, nor are overimitation, collaboration, and Theory of Mind necessarily unique to our species. All three phenomena emerge during early childhood and require social input to reach levels that we perceive as uniquely human. This leads to systematic variation in the ontogeny of each phenomenon in children across populations.

Given the importance of overimitation, collaboration, and Theory of Mind as key manifestations of human sociality, the question arises whether their ontogeny is actuated by similar mechanisms. In the following sections, I will review current evidence on potential links between these phenomena in young children. This includes both empirical investigations, as well as theoretical arguments on the interplay of overimitation, collaboration, and Theory of Mind. Since direct empirical evidence is sparse, I will also mention indirect evidence taken from other scientific fields, such as clinical psychology.

As described above, some researchers have argued that collaborative interactions provide an ideal learning ground for Theory of Mind-related skills to emerge because of their demands on mental coordination and behavioral interdependency (Carpendale & Lewis, 2004; Chevallier, Kohls, Troiani, Brodtkin, & Schultz, 2012; Tomasello, 2018). This especially applies for peer collaboration given that such contexts demand higher coordinative skills than those under adult supervision (Brownell et al., 2006). This suggested link is supported by empirical data. Infants' understanding of others' intentions is linked to their affiliative behaviors during peer cooperation (Hunnius, Bekkering, & Cillessen, 2009).

Such affiliative behaviors may, on the other hand, also be determined by the success of previous encounters with the interactant. Children collaborate more frequently with their peers after experiencing positive emotions during prior social interactions with them (Endedijk, Cillessen, Cox, Bekkering, & Hunnius, 2015; Schuhmacher & Kärtner, 2015). As such, these studies do not imply that the link between collaboration and Theory of Mind is necessarily monocausal. While collaboration may foster Theory of Mind by providing children with social experience needed to refine their social-cognitive abilities, sophisticated mindreading skills may also guarantee and reward successful collaboration. This, in consequence, may lead individuals with higher Theory of Mind skills to selectively prefer collaborative interactions.

Imitation and Theory of Mind have also been linked theoretically. For example, it has been argued that infant imitation is both an early precursor and a mechanism for children's acquisition of Theory of Mind (Meltzoff, 2007, 2010; Meltzoff & Decety,



2003). Accordingly, children learn to distinguish themselves from others through imitation before using this distinction to predict others' behaviors via mental state reasoning. Hence, imitation may equip children with necessary skills in self-recognition, upon which Theory of Mind skills can be consolidated at later ages. Recent research challenged this assumption by finding no evidence for ontogenetic links between neonatal imitation and social-cognitive skills at later ages (Redshaw et al., 2019). However, this finding primarily questions the reliability and validity of neonatal imitation per se. Whether imitation at later ages and overimitation in particular are linked to children's emerging skills in the social-cognitive domain is not yet clear.

The affiliative function of overimitation has been hypothesized to facilitate social interactions between children and caregivers (Nielsen, 2018; Over & Carpenter, 2013). Accordingly, overimitation may provide individuals with social experience needed to refine their Theory of Mind. At the same time, Theory of Mind may also boost children's overimitation given that copying intentionally modelled actions requires the imitator to consider the intentions and knowledge of the model (see also Gergely, Bekkering, & Király, 2002).

Only one study directly assessed the interplay between collaboration and overimitation in young children. Nielsen and colleagues (2016) assessed children's overimitation in peer contexts and found that the frequency of peer collaboration was linked to children's overimitation. However, this link was only evident among children from an indigenous Australian population, but not for children from a more urban, Western context. This suggests that cultural context shapes the interplay of

overimitation and collaboration, whereas the contextual variables contributing to such effects are yet unknown.

Indirect evidence for the interplay between collaboration, Theory of Mind, and overimitation may also be drawn from participants whose social functioning is impaired, such as children being diagnosed with Autism Spectrum Disorder (ASD). Clinical research comparing children with ASD to typically developing (TD) children has identified delayed onsets in Theory of Mind reasoning as a central symptom in ASD (Baron-Cohen, 1993, 2000). Significant impairments in collaborative behaviors have also been observed among children with ASD as compared to TD children (Liebal, Colombi, Rogers, Warneken, & Tomasello, 2008). Even though these children were generally able to engage in dyadic collaboration, they showed less attempts for reengaging a collaborative partner into a joint activity indicating an impairment in children's motivation for collaboration to cause this effect. Finally, overimitation has been identified as being de-emphasized among children with ASD as compared to TD children (Marsh, Pearson, Ropar, & Hamilton, 2013; Vivanti, Hocking, Fanning, & Dissanayake, 2017; but see Nielsen, Slaughter, & Dissanayake, 2013).

## **The Cognitive and Motivational Underpinnings of Sociality**

In the previous chapters, I described the significance of overimitation, collaboration, and Theory of Mind as key manifestations of human sociality. Children from diverse cultural contexts become proficient imitators, even though their reliance on overimitation differs across situations and cultural contexts (Berl & Hewlett, 2015; Clegg & Legare, 2016). Likewise, they learn to collaborate with others and develop a

Theory of Mind, even though the ontogeny of both of these phenomena varies substantially across populations (Mejía-Arauz et al., 2007; Alcalá et al., 2018; Mayer & Träuble, 2013; Dixson et al., 2017). Combined, these three phenomena both shape and are shaped by social interactions. From a comparative perspective, it can be subsumed that humans are not unique in either of these aspects of sociality. Chimpanzees can imitate, they can collaborate, and they can predict others' mental states via Theory of Mind reasoning. The difference between human sociality and chimpanzee sociality appears to be (a) a matter of degree rather than kind, and (b) founded within social interactions, particular those taking place in early childhood.

As mentioned above, the socio-cultural input children receive during their first years of life is an important determinant of sociality (Keller, 2007; Rogoff, 2003). Children should not, however, be conceived as passive recipients of this input. In contrast, they are actively involved in choosing when, with whom, and how to interact with others.

Going back to the initial definition of sociality as the tendency to engage in and benefit from social interactions, the psychological engines that constitute this sociality become ever more relevant to understand social development: Social motivation and social cognition (Hobson, 2002; Levinson, 2006; Tomasello et al., 2005).

The social-cognitive domain has long been discussed as a key driver of uniquely human levels of sociality (Herrmann et al., 2007; Premack & Woodruff, 1978; Call & Tomasello, 2008). It has been hypothesized that humans have evolved a highly specialized social-cognitive skillset enabling them to understand others' thoughts and

beliefs and, as a consequence, to predict their behaviors. As mentioned in the previous chapters, Theory of Mind has been interpreted as a key feature of this social-cognitive domain. Current evidence taken from comparative, developmental, and cross-cultural psychology suggests that Theory of Mind does not emerge in isolation and is neither innate, nor specific to our species. It is founded within social interactions and requires social experience to be consolidated gradually.

In light of this remark, it becomes even more important to take a closer look at the motivational underpinnings that foster social interactions throughout ontogeny. Even though social interactions may often be beneficial for both interactants, humans are also capable of and at times willing to navigate the world alone and without external interferences. To fully understand human sociality, social motivation and social cognition need to be considered in parallel as key constituents of sociality (Chevallier et al., 2012; Hobson, 2002; Levinson, 2006; Nielsen & Haun, 2016; Tomasello, 2014). To give a first orientation on this research agenda, I will introduce the *Social Motivation Theory of Autism* (Chevallier et al., 2012; see also Grelotti, Gauthier, & Schultz, 2002) in the next chapter. Even though Chevallier and colleagues' framework is originated in developmental psychopathology, the researchers offer suggestions which can be applied to developmental psychology and anthropology more generally. As such, I will also describe how our understanding of the ontogeny of overimitation, collaboration, and Theory of Mind can benefit from the framework offered by Chevallier and colleagues. Since motivation is a latent construct that cannot be observed directly but has to be inferred from behavioral manifestations, I

will also briefly describe some empirical approaches that may be useful for assessing social motivation in young children.

### ***The Social Motivation Theory of Autism***

The *Social Motivation Theory of Autism* treats social motivation as a “set of psychological dispositions and biological mechanisms biasing the individual to preferentially orient to the social world (*social orienting*), seek and take pleasure in social interactions (*social reward*), and to work to foster and maintain social bonds (*social maintaining*)” (Chevallier et al., 2012, p. 231). Social motivation is hypothesized to be derived from selective pressures that humans faced throughout their evolutionary history: In the socio-cultural niche in which humans evolved, an early emerging social motivation may have been of adaptive value for the species’ survival. The early ontogeny of social motivation can, in the light of the *Social Motivation Theory of Autism*, be conceptualized as a universal disposition that should show little to no variation across cultural contexts.

Throughout this dissertation, I will focus on the early ontogeny of *social reward* following the definition of Chevallier and colleagues (2012, or see above). I do so because of the central role of reward as a determinant of motivation more generally (Berridge & Robinson, 2003; Berridge, Robinson, & Aldridge, 2009; Touré-Tillery & Fishbach, 2014): Experiencing rewards triggers associative learning processes and biases individuals to attend to and pursue rewarding stimuli (Godman, Nagatsu, & Salmela, 2014). On a conceptual level, *social reward* may thus facilitate both *social orienting* (e.g., because of the increased salience of socially rewarding input) and *social maintaining* (e.g., in order to invest into socially rewarding input by forming long-

lasting relationships). This makes the reward aspect of social motivation even more interesting with regard to its ontogeny across cultures, since one would expect downstream effects of cultural variation in the reward value of social interactions on social attention and the formation of social bonds.

### ***Social Motivation and Imitation***

Around their second year of life, children use imitation to facilitate social exchange by displaying similarity with the model (Užgiris, 1981). Doing so can strengthen social bonds and increases affiliation between social actors (Nielsen, 2008; Over & Carpenter, 2012, 2013). Empirical findings support the increasing role of imitation as a “social glue” during child ontogeny (Nielsen, 2018). While children younger than 18 months of age selectively copy actions they have categorized as causally relevant and goal-directed, older children’s imitation is increasingly shaped by affiliative motivations. At 18 months of age, children imitate others selectively after being primed with third-party ostracism (Over & Carpenter, 2009). They show overimitation selectively when being observed by the model (Marsh et al., 2014; McGuigan & Robertson, 2015; Nielsen & Blank, 2011) and refrain from doing so in response to a model that signals social disinterest (Marsh, Ropar, & Hamilton, 2019). During middle childhood, social motives seem to become ever more important for actuating overimitation (Clay et al., 2018; Gellén & Buttelmann, 2019). On an individual level, children’s overimitation is linked to extraversion, which may indicate that children engage in overimitation out of a personal interest for social interactions (Hilbrink, Sakkalou, Ellis-Davies, Fowler, & Gattis, 2013). In sum, current evidence suggests that the ontogeny of overimitation is actuated by the social motivation to engage in social

interactions, and that this motivation may increase with age throughout childhood and beyond.

### ***Social Motivation and Collaboration***

As described above, humans are not the only species that can collaborate with others. However, the quality and quantity in which we work with others toward joint goals makes us outliers in the field of collaboration. One possible explanation for this may be that humans, and children in particular, like and seek to do so. When given the choice to obtain rewards alone or via collaborative efforts with a peer, most three-year-old children prefer to collaborate (Rekers et al., 2011). Children of slightly older ages invest more time in collaborative, rather than individual tasks and ascribe such activities more hedonistic value (Butler & Walton, 2013). Also, children at preschool ages smile more often when working with peers as compared to individually (Perlmutter, Behrend, Kuo, & Muller, 1989). The reward value of collaborative activities motivates children to rather wait for and reengage an inattentive adult co-player instead of completing the task individually (Warneken et al., 2006, 2012). Overall, children's liking and seeking of collaborative activities is well-documented in the context of social interactions with both peers and adults (Tomasello et al., 2005; Tomasello & Hamann, 2012).

### ***Social Motivation and Theory of Mind***

In their *Social Motivation Theory of Autism*, Chevallier and colleagues (2012) explicitly theorize social motivation as an ontogenetic driver of children's Theory of Mind. Social interactions, especially those that are of collaborative nature (Tomasello, 2018;

Tomasello et al., 2005), require individuals to coordinate and adapt to behaviors and perspectives of social partners. As individuals need to flexibly shift their point of view in order to coordinate themselves with social partners, they learn to understand and predict others' mental states (Tomasello et al., 2005). Theory of Mind is thus considered a consequence of such interactions (Carpendale & Lewis, 2004). Empirical evidence also indicates that the ontogeny of social motivation and Theory of Mind are intertwined. For example, children's orienting toward social stimuli, such as faces and biological motion, is linked to their performance on implicit false-belief tasks (Burnside et al., 2018). Socially-observant temperament relates to Theory of Mind both cross-sectionally (Lane et al., 2013) and longitudinally (Brink et al., 2015; Mink, Henning, & Aschersleben, 2014) in that more observant children are solving false-belief tasks at younger ages. On average, socially anxious children are impaired in their Theory of Mind skills as compared to TD children (Nikolić et al., 2019).

In the context of this dissertation, I hypothesize that social motivation (i.e., children's tendencies to overimitate or collaborate) and social cognition (i.e., their Theory of Mind) are ontogenetically linked features of sociality (Levinson, 2006; Tomasello et al., 2005). Following the *Social Motivation Theory of Autism*, I consider social cognition to be rooted in social motivation (Chevallier et al., 2012). Yet, this perspective does not imply that this relation is necessarily unidirectional. Social-cognitive abilities may themselves shape social motivation through their coordinative function in social interactions (Carpendale & Lewis, 2004; Roby & Scott, 2016; Tomasello, 2018; Tomasello et al., 2005).



In sum, both theoretical arguments and empirical data suggest that social motivation may be an ontogenetic driver of all three phenomena linked to sociality. While overimitation and collaboration may be directly conceptualized as manifestations of social motivation, Theory of Mind should also be shaped by children's motivation to interact.

### ***Assessing Social Motivation: Methodological Considerations***

Given the theoretical impact of social motivation in the ontogeny of sociality, surprisingly little systematic research has assessed the motivational (in comparison to the cognitive) aspects of sociality (Chevallier et al., 2012; Lyons, Phillips, & Santos, 2005; Tomasello, 2014; Tomasello et al., 2005). Assessing latent phenomena like motivation raises methodological concerns that may be particularly relevant when dealing with children and non-literate participants (Lyons et al., 2005; Over, 2016).

In adult research, scientists often utilize participants' introspection by explicitly asking them about motives and inner states (Touré-Tillery & Fishbach, 2014). For this purpose, surveys and interviews are often used to examine motivation among participants that are generally capable to reply adequately to such questions. Of course, such approaches can be efficient and valid means for assessing motivation. However, they may also suffer from response biases (e.g., social desirability) and a potential lack of introspection abilities (but see Measelle, Ablow, Cowan, & Cowan, 1998). Most crucially in the context of cross-cultural psychology, assessing quantitative data via questionnaires may lack validity in traditional, non-Western contexts (Chen, Lee, & Stevenson, 1995; Heine, Lehman, Peng, & Greenholtz, 2002). Assessing motivation in young children carries even more difficulties because young

children's introspection is not yet fully consolidated, which is why they cannot reliably articulate inner psychological states. As a consequence, other means are needed to estimate social motivation in young children. Behavioral observations seem to be a promising path. In the following section, I will review some phenomena that have previously been discussed as behavioral proxies of young children's social motivation.

***Context-Dependency of Behaviors.*** If certain behaviors are selectively performed to initiate social interactions, one would expect these behaviors to be more frequently performed in the presence of an audience. As described above, children show overimitation selectively in contexts in which the model is physically present (Nielsen & Blank, 2011), responsive (Nielsen, Simcock, & Jenkins, 2008), and observant (Marsh et al., 2019). Even though overimitation is also shown in the complete absence of an audience (Whiten, Allan, et al., 2016), the context-dependency of the phenomenon has been interpreted to reflect children's social motivation to affiliate and interact with the model (Marsh et al., 2019; Nielsen, 2008; Over & Carpenter, 2012, 2013).

***Reengagement Attempts.*** Children's social motivation may also be reflected in their tendency to form and adhere to joint activities with others. In one paradigm, children engage in a collaborative activity with an adult experimenter (Warneken et al., 2006). At some point, the adult withdraws from the joint enterprise for some seconds. Instead of continuing with the activity individually, two year-olds from urban Germany frequently attempt to reengage the recalcitrant adult (Warneken et al., 2006). Notably, they do so even though their partner is not needed for completing the

activity itself (Gräfenhain et al., 2009; Warneken et al., 2012). The researchers concluded that children's reengagement attempts illustrate that they are "motivated not just by the goal but by the cooperation itself" (Warneken et al., 2006; p. 559).

***Forced-Choice Preferences.*** Being motivated to engage in an activity should lead individuals to prefer this activity over others when given the choice to select between both alternatives. Rekers and colleagues (2011) introduced three-year-old children from urban Germany to a game in which they could freely choose whether to obtain a reward alone or in collaboration with a peer. Almost four out of five children chose to collaborate with their peer, indicating a strong social motivation for the joint action. In clinical psychology, two other sets of studies have assessed children's social motivation by utilizing forced-choice paradigms. First, one- to four-year-old children were given the choice between social (e.g., peer faces) and non-social (e.g., toy trains) images (Ruta et al., 2017). They learned that they could observe images of one or the other category by pressing buttons of a specific color on a tablet screen. This approach allowed for a systematic assessment of forced-choice decisions across trials. In accordance with the *Social Motivation Theory of Autism* (Chevallier et al., 2012), they found typically developing children to choose the social images more often as a group of children with ASD.

The so-called *Choose-a-Movie* paradigm (Dubey, Ropar, & Hamilton, 2017; Dubey, Ropar, & Hamilton, 2018) provides a novel approach for testing social motivation in children of older ages. In one study, children up from eleven-years-of-age onwards could choose between different video stimuli by unlocking them on a computer screen (Dubey et al., 2017). Individuals with ASD were less inclined than

control groups to invest effort into watching social videos. Again, these results supported the idea that social motivation is diminished among individuals with ASD (Chevallier et al., 2012). One advantage of this approach is that researchers can modify the effort or time participants need to invest in order to observe the video sequence of their choice. Utilizing the *Choose-a-Movie* paradigm to investigate social motivation in young children across diverse cultures is, however, challenging due to task demands (e.g., attention, memory, use of electronic devices).

***Expressed Emotions.*** Following Chevallier and colleagues (2012), young children should express more positive emotions during social interactions as compared to individual activities. Indeed, US-American children aged between four to nine years smile more often while solving tasks collaboratively than individually (Perlmutter et al., 1989). Perlmutter and colleagues' approach to count the instances in which children express positive emotions (e.g., smiles) in a given period can be complemented by assessing the intensity in which children express positive emotions when engaging in social interactions. Recently, researchers have established scales for coding children's happiness from video (Aknin, Hamlin, & Dunn, 2012). Such approaches correlate highly with other indicators for affect, such as the (Baby) FACS system (Oster, 2006) and may thus reflect a more intrinsic, hedonistic component of social motivation. However, positive emotions are not only displayed via facial expressions. For instance, another way for displaying happiness is by elevating one's body posture. Already at infant age, children do so when expressing positive emotions, such as pride (Hepach, Vaish, & Tomasello, 2015, 2017).

One difficulty in assessing social motivation through expressed emotions is that emotional displays can also serve other functions. For example, if children smile more frequently during collaboration as compared to individual activity (e.g., Perlmutter et al., 1989), this may either reflect the positive emotions children experience, or it may function as a communicative signal aimed at the interactant. In an observational study, Bainum and colleagues documented that about 95% of the instances in which U.S.-American preschoolers either smile or laugh, they are accompanied by others (Bainum, Lounsbury, & Pollio, 1984). This study illustrates the necessity to assess expressed emotions while controlling for the presence and visibility of others in order to disentangle affect displays as a communicative signal from the expression of emotions. As a second possible confound, it has to be noted that emotional expression varies considerably across cultural contexts (Crivelli, Russell, Jarillo, & Fernández-Dols, 2016; Jack, Garrod, Yu, Caldara, & Schyns, 2012). Yet, the expression of positive emotions via smiles shows only little variation across populations (see also Aknin et al., 2015).

***Persistence.*** If an individual is motivated to engage in social interactions, one would expect them to remain in such situations when given the choice to look out for alternative occupations. Butler and Walton (2013) found four-year-old children to persist longer in a demanding puzzle task after being told that a peer would join them later as compared to a condition in which children were told they would work alone throughout the study. The mere opportunity to collaborate drove children's persistence even though their social partner was not present yet (see also Master et

al., 2017). However, this effect might have been triggered by an obligation felt toward the peer rather than a social motivation to interact.

***Other Approaches.*** Of course, this list is far from comprehensive. Several other approaches have been used to assess children's (social) motivation. These include behavioral observations outside experimentally controlled contexts or biophysiological methods (e.g., skin conductance, pupillometry, salivary cortisol). Moreover, information on children's social motivation can be obtained via interviews with third parties, such as their parents, caregivers, and older siblings.

To conclude from the aforementioned approaches, current research indicates that young children are equipped with a species-typical social motivation, which in turn facilitates social interactions and sociality more generally. Social motivation may be crucial for understanding why humans overimitate and collaborate, and how they come to understand and predict others' behaviors by using a Theory of Mind.

## 2

# This Dissertation

## Research Focus

In the previous chapters, I described the hypothesis of overimitation, collaboration, and Theory of Mind as behavioral manifestations of young children's sociality. While the social-cognitive facet (e.g., Theory of Mind) of sociality has received considerable attention as a determinant of how humans make use of social interactions, our current knowledge about why humans engage in social interactions is still inconclusive. In the following sections, I will outline three systematic shortcomings of previous research and will argue how these shortcomings may have led to incomplete and potentially inadequate conclusions. Finally, I will explain how I addressed these shortcomings in the current dissertation.

### *Focus I: The Ontogeny of Sociality*

Focusing on the ontogeny of our experience and behavior is inevitable for understanding human psychology as a whole (Apicella & Barrett, 2016; Bjorklund, 2018; Bjorklund & Blasi, 2015; Legare, 2017; Liebal & Haun, 2018; Nielsen, 2012; Tomasello, 2019). Current evidence on the ontogeny of social motivation is, however, puzzling. While some studies suggest that socially motivated behaviors increase with age (Clay et al., 2018; Gräfenhain et al., 2009), a clear picture of the ontogeny of social motivation is still missing. With regard to children's Theory of Mind, it has also long

been assumed that children become better in corresponding tasks with age (Wellman et al., 2001; Wellman & Liu, 2004). However, recent evidence has suggested that developmental trajectories in children's Theory of Mind acquisition may differ across individuals and populations (Liu et al., 2008; Shahaeian, 2015; Shahaeian et al., 2011), and other studies have taken the universality of Theory of Mind into question (Mayer & Träuble, 2015, 2013). To understand the interplay of social motivation and social cognition, one aim of this dissertation was thus to investigate children's behaviors across a broad age range.

### ***Focus II: Individual Differences in Sociality***

The importance of development for understanding human behaviors suggests that different experiences gained throughout ontogeny lead to behavioral variation. The degree to which such differences are systematic cannot, however, be answered fully by applying developmental perspectives. A consequential step would thus be to assess the degree to which these differences in behavior reflect underlying psychological dispositions in a systematic way. Applied to the focus of this dissertation, understanding social motivation requires a focus on individual differences in how and when the phenomenon occurs in young children. If the behaviors previously linked to social motivation, such as overimitation or collaboration, are indeed manifestations of a shared, underlying disposition (i.e., social motivation), one would expect these behaviors to be linked at an individual level. Linking children's social motivation to social cognition can help to shed light on the phenomenon of sociality as a whole.

However, current evidence on the ontogeny of social motivation and social cognition is biased toward the assessment of differences at the level of groups or



conditions, rather than at an individual level (Rekers et al., 2011; Nielsen & Blank, 2011; Ruta et al., 2017; H. C. Barrett et al., 2013; Mayer & Träuble, 2015; but see Lane et al., 2013; Brink et al., 2015; Redshaw et al., 2019). Such approaches may be useful and efficient for identifying factors that shape child development more generally. However, a focus on interindividual differences is needed to reliably identify the psychological dispositions underlying child development.

### ***Focus III: Sociality Across Cultures***

Ontogenetic differences in human behavior do not just occur randomly across individuals. Humans live in groups, and these groups differ systematically with regards to the experience and information that group members receive through social learning. The aim of this dissertation is to generate findings about child development that generalize to humans living in various cultural contexts. This necessitates a cross-cultural perspective on the ontogeny of sociality (Fernald, 2010; Nielsen & Haun, 2016; Nielsen et al., 2017). Considering the role of culture for human psychology is particularly relevant in the field of evolutionary psychology. By addressing cross-cultural variability, researchers can learn about the interplay of biological and cultural evolution in shaping human psychology (Apicella & Barrett, 2016; Legare et al., 2018; Liebal & Haun, 2012).

A closer look at the studies leading to hypotheses on social motivation yields a lack of cultural diversity in participant samples. The vast majority of studies on children's social motivation were conducted with participants from Western, industrialized contexts. As mentioned above, such populations are not representative for the variability in which child development occurs around the globe (Henrich et al.,

2010; Nielsen et al., 2017). To assess the generalizability of previous studies outside Western, industrialized populations, I studied children from non-Western, traditional communities varying with regard to their socialization goals and practices.

According to Norenzayan and Heine (2005), participants from at least two diverse contexts are required to investigate the universality of human psychology. To gain a more thorough understanding of the role of culture in shaping sociality, however, such “two-cultures approaches” are not sufficient. Cultural contexts differ on a wide array of variables. Ecological and social variables may differ in a given cultural comparison, making it difficult to disentangle the potential effects of either of them. To capture and isolate the impact of cultural variables, it is thus important to include a third cultural context into the scientific inquiry (Norenzayan & Heine, 2005). Doing so improves the identification of ecological and cultural factors leading to observed variability in psychology and behavior.

Originally, I planned to investigate two populations differing as much as possible regarding their socialization goals and practices to address the universality of social motivation and social cognition. Thus, I wanted to assess children from an urban, Western environment (Leipzig, Germany) with children from a recent hunter-gatherer community, the *ǀAkhoe Hai||om* from Farm 6 (Namibia). As I will outline below, the cultural contexts of the *Hai||om* and Germany differ on countless ecological and socio-cultural dimensions. Explaining any cultural variation in children’s behavior would render conclusions about the underlying causes difficult. During participant recruitment in Namibia, I came in contact with the Ovambo of Oshivelo. As I will outline below, the Ovambo differ from both German and *Hai||om* parents in

crucial aspects of their social organization. Since Ovambo and Hai||om share an almost identical ecological environment, comparing children from these two contexts allowed for more systematic inquiry of the cultural differences as a function of population-specific socialization practices.

To test specific hypotheses about the universality of social motivation and social cognition by linking variation to distinct socio-cultural variables, I thus followed the “three cultures approach” (Norenzayan & Heine, 2005). In case of homogeneity across these populations, this approach would also be useful by documenting the universality of the phenomena across an array of cultural contexts.

## **Study Populations**

To summarize and relate important dimensions of each of the three cultural contexts that were investigated in this dissertation, I will first characterize each population by relying on both ethnographic literature and personal experience. I will also add ethnographic sources that describe populations which are comparable to the ones I investigated here with regard to their prototypical mode of subsistence. I do so because variability in mode of subsistence is typically accompanied by systematic variation in socialization goals and parenting practices (Barry et al., 1959; Keller, 2007) as well as in strategies for social learning more generally (Glowacki & Molleman, 2017).

Furthermore, I will classify each population into an overarching framework—the ecocultural model (Keller & Kärtner, 2013)—to allow for systematic comparisons within and across populations. I will hereby focus on two dimensions of autonomy

that have been utilized in the model: Action autonomy and psychological autonomy. Action autonomy refers to an “individual’s self-regulated capacity to perform complex behavioral necessities [...] independently” (Keller & Kärtner, 2013; p. 76) and is typically emphasized in populations in which social obligations and responsibilities are considered important. In such contexts, childhood is typically conceived as a period in which individuals do not yet fully contribute to the household. As a consequence, action autonomy is considered as a central socialization goal marking developmental progress.

Psychological autonomy describes the degree to which individuals, and children in particular, are perceived as autonomous agents who have their own desires and beliefs about the world (Keller, 2012) and whether the awareness and exploration of such mental states is emphasized culturally (Keller, 2012; Keller & Kärtner, 2013). Typically, populations with strong emphasizes on psychological autonomy also socialize their children toward individuality and self-reliance (Kärtner, 2015; Keller, 2007).

The ecocultural model supposes cross-cultural homogeneity in children’s needs for both psychological autonomy and action autonomy, and, at the other side of the spectrum, interpersonal relatedness (see also Ryan & Deci, 2000). While these needs are considered cross-culturally recurrent, the socialization goals and practices framing the fulfillment of children’s needs differ more substantially.

### ***The German Context***

German children receive high levels of pedagogical input and scaffolding from their parents and other adult caregivers. Formalized education, such as schooling, is

mandatory and children typically grow up in small nuclear families of about three to five household members in which their learning environment is mostly structured by adult caregivers. Social interactions between adults and children are typically child-centered and embedded in face-to-face settings. Self-fulfillment is a major socialization goal. Positive affect in social interactions is often reinforced and rewarded by caregivers (Keller, 2007, 2009). According to the ecocultural model, urban Germany represents a prototypical milieu in which children's psychological autonomy is highly valued (Keller & Kärtner, 2013). Interpersonal responsibilities are perceived as less important than personal choice and children are free to navigate social interactions according to their own needs and desires. At the same time, adults mirror children's emotions through "mind-minded" interaction styles and scaffold children's activities to establish a learning environment that is considered optimal (Kärtner, 2015; Keller, 2007, 2016; Rogoff, 2003). Social interactions between children and both peers and adults are highly valued and scaffolded "as long as they are self-chosen and not enforced by others" (Kärtner, 2015, p.2; see also Markus & Kitayama, 1994). While children perceive high levels of psychological autonomy, they are not required to contribute to any ecological income or household chores. Hence, action autonomy is comparably low and typically not prioritized until late childhood or adolescence.

Today, the prevailing subsistence mode in Germany is that of a market economy. Henrich and colleagues used the defining characteristics (Western, Educated, Industrialized, Rich, Democratic) of such cultural milieus to establish an acronym that resembles the peculiarities of such populations—they are WEIRD (Henrich et al., 2010). From an evolutionary or even historical point of view, WEIRD

contexts are a recent phenomenon. The predominant subsistence mode of our species, in contrast, has been that of hunting and gathering (also often referred to as foraging).

### ***The Hai||om Context***

The defining subsistence niche of our species is that of foraging: For more than 90% of our evolutionary history, humans lived in mobile family bands relying on hunting prey and gathering nuts, plants, and other bushfood from the wild. Interestingly, contemporary populations that exhibit this foraging lifestyle typically share a distinct set of socio-cultural variables (Hewlett, 2016). According to Hewlett and colleagues, these cultural schemata include the appreciation of individual autonomy, egalitarianism, and sharing on demand (Boyette & Hewlett, 2017; Terashima & Hewlett, 2016). Hunter-gatherers like the Hai||om give comparably little emphasis on direct, child-centered pedagogy to structure children's social learning (Boyette & Hewlett, 2017; Hewlett et al., 2011; Hewlett & Roulette, 2016; Lew-Levy, Lavi, Reckin, Cristóbal-Azkarate, & Ellis-Davies, 2018; Lew-Levy et al., 2017).

The Hai||om are an ethnic group living in the dry savannah of northern Namibia. Their traditional habitat is the Etosha pan and the surrounding areas. Typically, men hunted game and women gathered bushfood. Today, most Hai||om live in small farms and villages. As many former hunter-gatherers, they suffer from political and societal marginalization. Today, most Hai||om cannot follow their traditional lifestyle anymore due to their traditional hunting habitats being owned and occupied by third parties.

Some Hai||om, especially those living in the more remote and rural areas, have nonetheless maintained crucial aspects of their cultural identity. Even though some

Hai||om in rural areas engage in paid jobs and receive governmental aid (Dieckmann et al., 2014), foraging is still practiced commonly. For example, women and children gather bushfood on a daily basis. Hunting, although illegal, is said to be practiced commonly. This aspect is of particular importance not just because it illustrates that the rural Hai||om are not (yet) fully integrated into market economy, but also because hunting and gathering are still perceived as major aspects of their cultural identity (Dieckmann et al., 2014; Widlok, 1999). The emphasizes on autonomy, egalitarianism, and sharing on demand, are crucial elements of Hai||om culture and are still practiced today (Schäfer, Haun, & Tomasello, 2015; Widlok, 1999). Given that the cultural norms and schemas of the Hai||om are derived from a long history of a foraging lifestyle, and since many Hai||om still emphasize foraging as a defining characteristic of their own cultural identity, I will refer to the Hai||om as hunter-gatherers throughout this dissertation (see also Barndard, 2002).

In this dissertation, Hai||om children from two populations participated in the studies: Farm 6 and Ondera. Children from Farm 6, Mangetti West, were tested in study 1 and study 2. Farm 6 is a rural settlement with around 300 Hai||om inhabitants. The settlement is situated next to a cattle farm at which some men find seasonal employment. At |Khomxa Khoeda primary school, children have the opportunity to attend school from grade zero to grade five. School attendance rates are reported by local teachers to be low. In order to improve the statistical power of studies 2 and 3, children from a neighboring settlement named Ondera were also assessed. Ondera is located north-east of Tsumeb in Namibia and was established in 2012 as a resettlement project for local Hai||om residents. Although no census is available,

village representatives estimate that there are between 500 to 1,200 permanent residents at Ondera. Some Hai||om in Ondera find employment at the local vegetable farm while others sell handmade crafts at the neighboring Etosha National Park. Gathering bushfood and occasional hunting are reported by the people in Ondera. Even though the distance between Farm 6 and Ondera is more than 90km, people often move between the two villages by foot or via hitchhiking to visit relatives or to move temporarily. Children can attend Ondera primary school and a pre-school. School attendance is reported by local teachers to be low and infrequent.

The parental emphasizes on psychological and action autonomy are central socialization goals among the Hai||om (Terashima & Hewlett, 2016; Widlok, 1999). Hai||om children can freely decide about their activities from an early age and social obligations toward peers or adults are given little importance as compared to Western, industrialized populations. Importantly, the high levels of both psychological and action autonomy with which Hai||om children are equipped with are not representative for children from rural-small-scale societies per se. Other modes of subsistence, such as pastoralist societies, are often characterized by highly distinct socialization goals and practices (Barry et al., 1959; Lancy, 2008).

### ***The Ovambo Context***

The Ovambo of northern Namibia, are traditionally agro-pastoralists who rely on both the cultivation of millet (Omahangu) and corn as well as on herding cattle and goats. In Oshivelo, a small town close to Ondera with around 2,000 inhabitants, most families rely on a mix between market economy (e.g., paid jobs at the local police station, selling food at local markets) and traditional agriculture. In accordance with



other farming ecologies (Barry et al., 1959), the Ovambo emphasize interpersonal relatedness, obedience to social and behavioral prohibitions, and the adherence to social hierarchies as key socialization goals and practices (see also Zimba, 2002; Zimba & Otaala, 1993). To enforce these goals, parents typically make use of punitive practices and discipline children verbally if they do not behave adequately. Family relations are given high importance and children are expected to engage in household chores from early on.

Among the Ovambo, family life is structured through a matrilineal system (Brown, 2011; Brown & Bartholomew, 2014). Children are often fostered within their broader family system in order to strengthen social ties and to toughen them (Brown, 2011). While children typically spend their first years of life on rural farms, they are often sent to urban areas when reaching preschool ages in order to attend institutionalized education at public schools. During school holidays, children typically visit farms owned by relatives on which they are tasked with chores to contribute to the subsistence of their family (Zimba & Otaala, 1993). Household chores and play are considered as interwoven tasks that enable social learning in young children (Zimba, 2002).

The Ovambo value age-related hierarchies, respect, and interpersonal responsibilities in their parenting practices (Brown, 2013; Nampala, Shigwedha, & Silvester, 2006; Zimba, 2002). Ovambo tribes are traditionally structured into kingdoms and subtribes. Even though these kingships are no longer equipped with official powers in Namibian politics, kingdom-based family relations are given high relevance in everyday life of the Ovambo. Most Ovambo in Oshivelo characterize

themselves as either belonging to the tribe of the Oshindonga or the Oshikwanyama. Participation and observation are central modes of social learning, while adult-child pedagogy is emphasized at an intermediate level in comparison to the Hai||om and German parenting practices (Zimba, 2002).

With regards to the ecocultural model (Keller & Kärtner, 2013), the Ovambo are typical representatives of the relational cultural context (Kärtner, 2015). On the psychological level, Ovambo children are not perceived as individual beings with distinct psychological needs and intentions until they reach adulthood (Brown & Bartholomew, 2014). Children's mental states are not considered as being equal to adult-like experience. Instead, child socialization aims at integrating children into a broader, hierarchical context of interpersonal relations. On the action domain, parenting strategies typically emphasize "self-regulated accomplishment[s] of role-based obligations and responsibilities" (Keller & Kärtner, 2013, p. 76). Cultural emphasizes on psychological autonomy, action autonomy, and child-centered pedagogy are summarized separately for each of the three populations in Table 1.

Table 1

	<b>Subsistence Economy</b>	<b>Psychological Autonomy*</b>	<b>Action Autonomy*</b>	<b>Child- Centered Pedagogy</b>
<b>Urban German</b>	market economy	+	–	+
<b>Rural Hai  om</b>	hunting and gathering	+	+	–
<b>Rural Ovambo</b>	agro- pastoralism	–	+	±

*Note.* \*applied from Keller & Kärtner (2013)

## Aims and Approaches

In this dissertation, I assessed young children's overimitation, collaboration, and Theory of Mind in a set of three studies. I observed these phenomena with regard to their ontogeny, interindividual differences, and cross-cultural variability among German, Hai||om, and Ovambo children. To combine these approaches, it was important to utilize procedures that allow for precise and comparable conclusions across participants. I thus chose (quasi-)experimental approaches to observe and compare participants' behaviors under controlled conditions in each of the three studies.

In study 1, I tested the degree to which young children's overimitation would vary across the three populations. I manipulated the attentive state of the model in a within-subjects design to estimate whether overimitation would be actuated by the attentive state of the model across populations. Using a cross-sectional research

design, I assessed overimitation in children between three to eight years of age in order to investigate whether the behavior would become more frequent with increasing age (which has been observed among WEIRD participants; see Clay & Tennie, 2018; McGuigan et al., 2011). Finally, I linked children's overimitation to their reengaging behaviors in a collaborative activity to assess the degree to which interindividual differences in social motivation would drive overimitation across populations.

To further explore and extend the results gained from study 1, the second study investigated young children's overimitation using a novel procedure. I minimized cognitive and attentional task demands to isolate the social motivation in overimitation in three- to seven-year-old Hai||om and German children. Lowering cognitive task demands also allowed for a more critical test of the developmental increase in the frequency of overimitation, given that the contribution of memory and attention on overimitation could be minimized methodologically. Finally, a systematic assessment of the interindividual differences in children's overimitation allowed novel insights into the prevalence of overimitation on a population level.

The third study investigated children social motivation for collaborative activities with their peers across all three populations. Three- to eight-year-old children were assessed with regard to their tendency to express positive emotions during collaboration with a peer, as compared to individual activity. Moreover, the same participants were observed in their preferences for either collaborative or individual activities in a forced-choice task. The ontogeny of both proxies for social motivation was assessed separately for each cultural context. At an interindividual

level, I linked both measures to assess the construct validity of social motivation for peer collaboration. Finally, I assessed cross-cultural variability in participants' social cognition using a set of Theory of Mind tasks. Children's performance in this domain was analyzed regarding its cross-cultural and ontogenetic variability as well as its relation to both their expressed emotions during collaboration and their preferences during forced-choice trials.

Each of the three studies are summarized as individual chapters. To ensure that each study can be interpreted in its own right, each of these chapters comprises an introduction, sections for methods and results, and a discussion. This may lead to redundant definitions and arguments, but allows for an easier comprehension for readers interested in the single studies of this dissertation. In the general discussion, the findings of all three studies will be embedded into an overarching framework on the ontogeny of social motivation and social cognition.

## **Ethics Statement**

All studies tested in this dissertation strictly adhered to the ethical principles of the German Psychological Society (DGP) and the American Psychological Association (APA). All studies were designed to be non-invasive observations of children's behaviors in experimentally structured scenarios. Children were not exposed to physical or psychological harms and risks greater than those they encounter in their daily lives.

Research designs in this form have been approved by the Ethical Committee at the Medical Faculty, Leipzig University (title of the approval: "Investigating the non-

pathological development of social behavior and competences in children and adults by using behavioral, peripheral physiological, and psychometric methods”; reference number 169/17-ek), the Ministry of Home Affairs and Migration of the Republic of Namibia, the Regional Council of Oshikoto Region in Namibia, and the Working Group of Indigenous Minorities in Southern Africa (WIMSA).

Informed consent of caregivers (verbally or via signature, depending on parents’ literacy) and school principals (via signature) were obtained prior to children’s participation. Children were free to stop participation at any time during the studies.

# 3

## Study 1

### Being Observed Increases Overimitation in Three Diverse Populations<sup>1</sup>



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<sup>1</sup> A research article based on this study has been published in *Developmental Psychology* (doi: <http://dx.doi.org/10.1037/dev0000832>)

## **Abstract**

*From a young age, children in Western, industrialized societies overimitate others' actions. However, the underlying motivation and cultural specificity of this behavior have remained unclear. Here, three- to eight-year-old children (N= 125) from two rural Namibian populations (Hai||om, Ovambo) and one urban German population were tested in two versions of an overimitation paradigm. Across cultures, children selectively imitated more actions when an adult model was present compared to being absent, denoting a social motivation underlying overimitation. At the same time, children's overimitation was not linked to their tendency to reengage the adult in a second, independent measure of social motivation. These results suggest that, across diverse cultures, children's imitative behavior is actuated by the attentive state of the model.*



## Introduction

For good and bad, children imitate (almost) everything. Being confronted with an immense number of skills and behaviors they have to learn to grow into fully-fledged members of their society, imitation is invaluable. It enables individuals to learn skills that are essential for living in human groups. Regardless of whether it is a group-specific ritual or an important hunting technique, imitators can avoid the costs and risks of trial-and-error learning or innovation. Instead, they make use of others' knowledge by copying their behaviors.

Already infants copy others' actions with a fidelity that is unmatched by any other species (Legare & Nielsen, 2015). Children imitate others even if the model's actions do not fulfill an obvious causal function. This overimitation, defined as the faithful copying of visibly causally irrelevant actions, has gained much scientific attention in the past decades (Horner & Whiten, 2005; Lyons et al., 2007; Hoehl et al., 2019). In the standard paradigm, children observe an adult model performing multiple causally irrelevant actions on an apparatus before retrieving a reward from it. When given the opportunity to manipulate the apparatus themselves, children show overimitation by copying these irrelevant actions with high fidelity. Overimitation first occurs in children's second year of life and becomes more frequent with age (McGuigan et al., 2011).

One influential theoretical account holds that overimitation serves a social function to affiliate with the model (Marsh et al., 2019; Nielsen, 2008; Nielsen & Blank, 2011; Over & Carpenter, 2013). Empirical support for this account comes from studies showing that four-year-old children are more likely to show overimitation

when an adult model is present compared to when the model is absent or displays social disinterest (Nielsen & Blank, 2011; DiYanni, Nini, & Rheel, 2011; Marsh et al., 2019). This social function of overimitation is assumed to become increasingly important with age (Clay et al., 2018; DiYanni et al., 2011). Importantly, the specific social motivations underlying children's overimitation may be manifold. In addition to a desire to affiliate, overimitation can also be shown to adhere to social norms (Keupp, Behne, & Rakoczy, 2013) or to conform to others, such as when learning from a group of models (DiYanni et al., 2015; McGuigan & Robertson, 2015). Together, these accounts converge on the idea that overimitation serves as a "social glue", facilitating social interactions and allowing uniquely human forms of cumulative culture (Legare & Nielsen, 2015; Nielsen, 2018; Nielsen & Haun, 2016).

To date, most studies examined overimitation in children from Western populations. This sampling bias limits the generalizability of these findings outside such populations. Instead, claims about the universality and evolutionary adaptivity of overimitation require both developmental and cross-cultural evidence. To fully understand whether and how overimitation varies across cultures, a systematic investigation of the social contexts under which the behavior is performed is also required (Nielsen, 2018; see also Norenzayan & Heine, 2005).

The results from previous studies that have systematically investigated overimitation cross-culturally are mixed. Some studies documented cross-cultural and developmental homogeneity in children from a recent South-African hunter-gatherer population as compared to children from Western, urban societies (Nielsen & Tomaselli, 2010; Nielsen et al., 2014). In contrast, other work revealed low rates of

overimitation among hunter-gatherer children from the Central African Republic (Berl & Hewlett, 2015). These findings have been discussed with regard to participants' diverging exposure to Western pedagogy and artefacts, as well as in reference to procedural differences between the studies (e.g., whether the model is a member of the in-group or the out-group; see Berl & Hewlett, 2015). More data from hunter-gatherer populations is needed to clarify the prevalence and function of overimitation given the informative value of hunter-gatherer populations for our understanding of the societal circumstances under which humans have evolved (Barndard, 2002; Hewlett, 2016).

Few cross-cultural studies to date have varied the social context in which overimitation was assessed. When task instructions were framed instrumentally (e.g., by referring to *how* to make a necklace), children from rural Vanuatu imitated actions with higher fidelity than children from the U.S. (Clegg & Legare, 2016). When the same task was framed conventionally (e.g., the model claiming that *everyone* would make a necklace like that), no differences occurred between the two populations. In another study, Chinese-American children showed more overimitation than European-Americans when confronted with actions modelled by a group (DiYanni et al., 2015). These findings thus highlight the potential importance of cultural context on the social function of overimitation (Heyes, 2012a). However, the attentive state of the model, such as whether the model observes the child during the task (Nielsen & Blank, 2011; Marsh et al., 2019), has thus far not been systematically assessed in cross-cultural comparisons.

In the present study, I tested the “functional universality” (Norenzayan & Heine, 2005) of overimitation by investigating its ontogeny and social function among young children from three diverse populations. I investigated urban, middle-class children from a mid-sized German town as representatives for participants from Western, industrialized contexts (Henrich et al., 2010). Further, I assessed overimitation in children from two rural Namibian communities: The Hai||om and the Ovambo. While the Hai||om have historically relied on hunting and gathering, the Ovambo are traditionally agro-pastoralists.

These different subsistence styles are mirrored in very distinct patterns of childrearing. Frequent schemas among hunter-gatherers, such as egalitarianism and autonomy (Hewlett, 2016), are highly valued among the Hai||om (Widlöck, 1999). Children are given high levels of individual autonomy from an early age. Direct pedagogy is rare compared to other modes of social learning, such as observation and individual learning (Boyette & Hewlett, 2017; Lew-Levy et al., 2017). Children spend most of their time in mixed-age peer groups without being closely supervised by adults (Salali et al., 2019). Among the Ovambo, assertive and authoritarian means of parenting are frequent (Brown, 2011). Parents expect their children to conform and obey to elders. In contrast to the Hai||om, Ovambo children are tasked with household duties from early on. Similar to the Hai||om, they spend most of their time together with peers and gain little experience in dyadic, child-centered pedagogy as compared to Western populations.

Comparing children’s overimitation across these cultural samples allowed me to disambiguate previous findings on the occurrence of overimitation among hunter-

gatherer populations. If overimitation is a culturally-specific adaptation for social learning in the context of child-centered pedagogy (Berl & Hewlett, 2015), both Hai||om and Ovambo children should show lower levels of overimitation than their German counterparts. If, in contrast, individual autonomy would be crucial, one would expect Hai||om children to show lower levels of overimitation than both German and Ovambo children.

To further investigate the affiliative function of overimitation cross-culturally, I varied whether the model was attentive during children's overimitation or not. If the social function of overimitation was culturally robust, one would expect all children to show more overimitation when being observed by the model (functional universality hypothesis). If this social function would itself be shaped culturally (encultured functionality hypothesis), the autonomous Hai||om should not differ in their use of overimitation whether or not the model was attentive. In populations emphasizing obedience, such as the Ovambo, children should imitate an adult selectively when being observed.

I tested children from early- to middle childhood (Berl & Hewlett, 2015; Nielsen & Tomaselli, 2010). This allowed me to investigate whether age-related increases in overimitation could be generalized across cultural contexts (Berl & Hewlett, 2015; McGuigan et al., 2011). In order to elaborate on the social-motivational function of overimitation, I included an additional exploratory measure of social motivation in the form of children's reengagement of a recalcitrant co-player in a collaborative social activity (Warneken et al., 2006; Gräfenhain et al., 2009). This allowed me (a) to

investigate the cross-cultural variability of this social phenomenon and (b) to examine the convergent validity of social motivation in overimitation cross-culturally.

## **Methods**

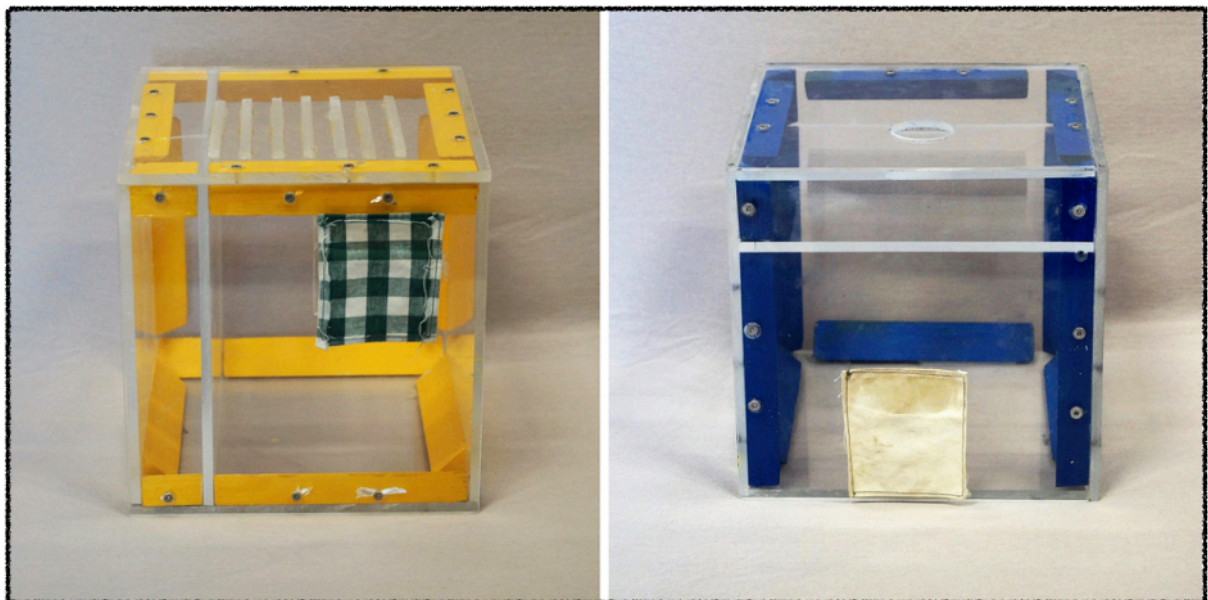
### ***Participants***

Thirty-five Hai||om children from Farm 6 ( $M_{Age} = 5.7$ , 13 girls, age range = 3 to 8 years), thirty-nine Ovambo children from Oshivelo ( $M_{Age} = 4.4$ , 21 girls, age range = 3 to 7 years), as well as fifty-one children from Leipzig, Germany ( $M_{Age} = 5.5$ , 25 girls, age range = 3 to 7 years) participated in this study. An additional five Hai||om children, one Ovambo, and one German child preferred not to participate. Six German children were tested but excluded from the data because of experimenter errors (e.g., wrong order of irrelevant actions in overimitation tasks). Nine of the Hai||om children were tested in Oshivelo to increase the sample size of this cultural context.

### ***Materials***

Children engaged in a fixed test sequence consisting of four tasks in a within-subjects design. Tasks 1 and 3 were two versions of an overimitation-task (Horner & Whiten, 2005; Nielsen & Blank, 2011) in which an adult experimenter modeled four causally irrelevant actions on a transparent box before retrieving candy from it (see Figure 1). Children were then given the opportunity to obtain candy themselves in the experimenter's presence (model-observing condition) and in the experimenter's absence (model-unobserving condition; order of conditions counterbalanced across participants; henceforth: overimitation box-I and overimitation box-II with reference

to the order of tasks). All participants could consume the rewards immediately after retrieving them so that further participation in the study was not affected by the retrieval of the candy. Candies are well-known to children across all three populations (in contrast to, for example, stickers and toys) and were thus chosen to ensure comparable value of rewards. In addition, a filler task was included in the study of which I did not analyze the data (see Appendix A for details). After the subsequent task involving overimitation box-II, children engaged in a reengagement task (Warneken et al., 2006; Gräfenhain et al., 2009). Therefore, a wooden toy tower with 8 separate building blocks was used. As the adult was not needed as a “social tool” for building the tower, this task served as a strict test of children’s motivation for collaboration (Gräfenhain et al., 2009; Warneken et al., 2012). Building blocks had varying colors and sizes.



*Figure 1.* Polycarbonate boxes used in overimitation tasks

## ***Procedure***

***Overimitation I.*** Children came into the testing room together with the adult experimenter and were asked to sit down next to the experimenter and overimitation-box I. The experimenter said “look” in the child’s mother tongue before performing some causally irrelevant actions on overimitation box-I. Acting on the yellow-transparent box, these actions were as follows: Picking up a stick from the top of the box, (i) tapping one’s own hand with the stick (2x), (ii) rubbing the stick on top of the box (2x), (iii) drawing a circle around the box with a stick (2x) and finally (iv) lifting a small curtain on the front side of the box using the stick (1x) to obtain the reward from an indentation behind the curtain. When children were confronted with the blue-transparent box, the following actions were modeled: (i) Tapping one’s hand with the stick (2x), (ii) putting the stick into a top hole on the box (2x), (iii) drawing a circle around the box with a stick (2x) and finally (iv) retrieving the candy while using the stick to lift the curtain (1x). After the initial demonstration, these sequences were repeated once more. The experimenter then put another reward in the box, put down the stick on the box and moved the box into the participant’s reach. The experimenter then said “now you!” in the mother-tongue of the child. Depending on condition, the experimenter either added “I am here and will watch you.” and sat next to the participant (model-observing condition) or added “I am not here and will not watch you.”, before walking to a corner of the room and turning the back to the child (model-unobserving condition). Here, the experimenter pretended to write down some notes and to not pay attention to the child. Children were given the opportunity to obtain the reward for one minute.



**Overimitation II.** After the filler task, overimitation box-II was presented to the child by the experimenter. Depending on condition run on trial 1, the experimenter was either observing (model-observing condition) or turned away (model-unobserving condition) when the child was given the opportunity to retrieve the reward.

**Reengagement.** Hereafter, the child and the experimenter played a collaborative game of stacking wooden pieces to form a tower. The experimenter then encouraged children to take turns (“now you!”, “now me!”) in building the tower by stacking the wooden pieces. The experimenter and the child completed the tower twice while the experimenter emphasized the turn-taking nature of the game: (“now you!”, “now me!”, “now you!”, etc.). He then put the pieces of the tower on the floor and encouraged participants to start building the tower again. This time, the experimenter did not engage in the activity but remained looking behind the child in an upper corner of the room and remained motionless. Children could either continue playing the game, wait for the co-player to re-attend, or attempt to actively reengage him.

### **Coding**

**Overimitation I & II.** Children’s actions on the boxes were coded from tape by an adult coder blind to hypotheses. For each of those irrelevant actions that were modelled twice (i – iii; see Table 2), children could earn a score between 0 and 2. Exact imitation (modelling the action precisely as often as the model did) was coded as 2, imprecise imitation (modelling the action only once or more than twice) was coded as 1, and no imitation was coded as 0. Only irrelevant action *iv* was scored as either 0 or

1, since the frequency of children action here (lifting the curtain using the stick) was not modelled explicitly<sup>2</sup>. A child could thus earn a score between 0 (by obtaining the reward without copying any irrelevant action) and 7 (by exactly copying each step). I also coded the full sample. Overall, interrater agreement was excellent (model-observing condition: Intraclass correlation coefficient/*ICC* = .95, model-unobserving condition: *ICC* = .93).

***Reengagement.*** In the period in which the experimenter was not responsive to participants, children's behavior was coded in one-second-intervals according to the following (mutually exclusive) categories: When children waited, did unrelated actions (e.g., ambiguous play with blocks), or continued building the tower, they were scored as 0. If children tried to reengage the co-player in one or more attempts, they were scored as 1 for the respective second. The initial 20 seconds in which the experimenter was not responsive to children's response were coded. Children could earn a score between 0 and 20, higher scores indicating more time invested in reengaging behaviors. The full sample was coded by a coder blind to hypotheses. This data was used to run the statistical analyses. In order to estimate reliability, I also coded the full sample. Interrater reliability for reengagement behaviors per 20 seconds was excellent (*ICC* = .89).

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<sup>2</sup>Action iv was only scored as irrelevant if participants imitated the model by lifting the curtain with a stick. If children used more efficient means (such as lifting the curtain with their hands or reaching through it), they were scored as 0 on action iv (see also Appendix A)

Table 2

Task	Score	Coding details
OI I & II	0 – 7	Imitation of causally irrelevant actions
		<i>i</i> tapping own hand with the stick (1), exact imitation (2) <i>ii</i> rubbing stick on top of the box/putting stick into hole on top of box (1), exact imitation (2) <i>iii</i> drawing circle around box with stick (1), exact imitation (2) <i>iv</i> lifting curtain before retrieving reward by using the stick (1) <i>i – iv</i> no imitation (0)
RE	0 – 20	Active attempts of child to reengage E (1) or no attempt (0) in 20 second of interruption (coded per second; see Appendix A)

*Note.* Coding details; Overimitation (OI I and OI II) and Reengagement (RE); “exact imitation” refers to copying the irrelevant actions in the exact same quantity as modelled by the adult (two times in a row for actions *i*, *ii*, and *iii*)

### ***Statistical Models and Preliminary Analyses***

All data was analyzed in *R* (R Core Team, 2018). For the first analysis, I ran a linear mixed model (LMM) using the package *lme4* (Bates, Maechler, & Bolker, 2017). Statistical significance of each predictor was tested through likelihood ratio tests in which a full model was compared to a reduced model without the respective predictor variable. For the second analysis, I ran a generalized linear model (GLM) with Poisson error distribution to investigate children’s reengagement behaviors. Statistical significance of each predictor was tested using likelihood ratio tests in which a full model was compared to a null model not containing the respective predictor.

**Overimitation.** I investigated whether children's overimitation-scores varied as a function of three predictors: Condition (model-observing condition vs. model-unobserving condition), populations (German, Hai||om, or Ovambo), and age entered as a continuous variable. Sex was included as a control variable given that its potential influence on overimitation has recently been discussed (Frick, Clément, & Gruber, 2017). I included subject ID as a random intercept to account for within-subject variance. Visual inspection of the data indicated normally distributed residuals. Initial analyses revealed no statistical effects of box type ( $\chi^2(1) = 0.36$ ,  $p = .550$ ) or trial number ( $\chi^2(1) = 1.85$ ,  $p = .173$ ). These variables were thus not included in the main analysis. In addition, no statistically relevant three- or two-way interactions between predictors were found. Results reported below refer to a model including main effects only.

**Overimitation and Reengagement.** I entered children's reengagement score (0-20, see above) as the outcome variable into the model. OI-score in the model-observing condition (0-7) and population (German, Hai||om, or Ovambo) were included as predictors. Sex and age were included as control variables. Visual inspection of the data indicated normally distributed residuals. No statistically significant two-way-interaction between the predictors was found. Model estimates reported below refer to a model including main effects only.

## Results

**Overimitation.** Children's overimitation varied by condition. Children in the model-observing condition ( $M = 3.75$ ,  $SD = 1.82$ ) showed more overimitation than

those tested in the model-unobserving condition ( $M = 3.31$ ,  $SD = 1.70$ ;  $\chi^2 (1) = 6.96$ ,  $p = .008$ ). Children's overimitation further varied between populations. German children ( $M = 4.30$ ,  $SD = 1.80$ ) overimitated more than Hai||om ( $M = 3.30$ ,  $SD = 1.40$ ) and Ovambo children ( $M = 2.60$ ,  $SD = 1.51$ ;  $\chi^2 (2) = 22.26$ ,  $p < .001$ ). Overall children's overimitation increased with age ( $\beta = 0.58 \pm 0.08$ ,  $\chi^2 (1) = 40.84$ ,  $p < .001$ , see Figure 2). There was no significant effect of sex on children's OI,  $\chi^2 (1) = 0.62$ ,  $p = .430$ .

To further explore the robustness of the effect of condition across populations, I ran separate models for each cultural group. Regression estimates suggested similar effects of condition across groups ( $\beta_{\text{Germany}}$  [95%-CI] = 0.36 [-0.14; 0.86];  $\beta_{\text{Hai||om}} = 0.44$  [-0.14; 1.03];  $\beta_{\text{Ovambo}} = 0.51$  [-0.07; 1.10]). To account for unequal sample sizes in the current data, I ran bootstrap simulations with 20,000 iterations ( $n = 51$  for each population, given that this was the number of participants in the largest subsample). Bootstrapped intervals suggested robust effects of condition when running the main analyses with identical sample sizes for each group (95%-CI of  $\beta$ -coefficients: [0.13; 0.69]).

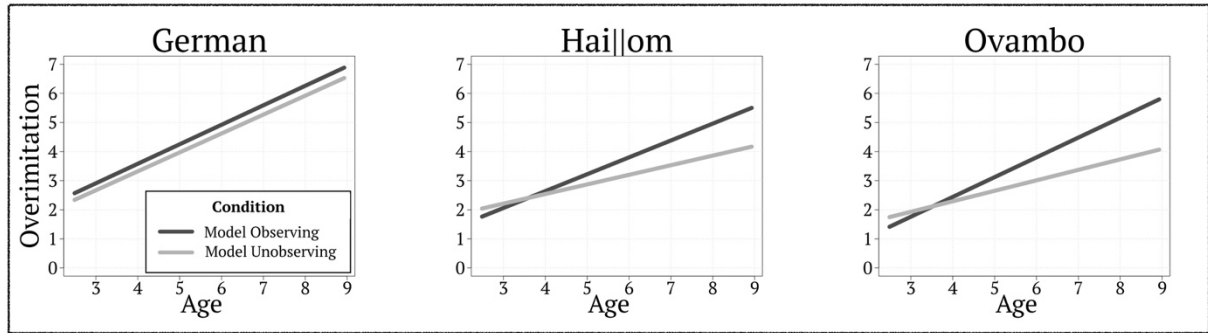


Figure 2. Overimitation within each population as a function of age and condition; Solid lines represent the fitted values of a linear model containing predictors and controls of the statistical models described in the method section

**Overimitation and Reengagement.** Children’s reengaging behaviors were not significantly related to their overimitation,  $\chi^2 (1) = 0.14, p = .710$ . At the same time, children’s reengagement varied across populations. German children ( $M = 12.35, SD = 5.69$ ) showed more reengaging attempts than both Hai||om ( $M = 6.67, SD = 4.53$ ) and Ovambo children ( $M = 7.08, SD = 4.75; \chi^2 (2) = 59.74, p < .001$ ). There was no significant effect of sex ( $\chi^2 (1) = 2.51, p = .113$ ) or age ( $\chi^2 (1) = 1.10, p = .294$ ) on children’s reengagement behaviors.

## Discussion

In the current study I investigated the prevalence and social modulation of overimitation in children from three diverse populations. While German children generally showed more overimitation than their Hai||om and Ovambo counterparts, participants across populations engaged in higher levels of overimitation when they were observed by the adult model. I thus find support for the functional universal

hypothesis in that, despite cross-cultural variability in its prevalence, overimitation is actuated during social interactions across diverse populations.

Overall, German children showed more overimitation across both experimental conditions than children from the two Namibian populations. These results lend support to accounts suggesting overimitation to be a learning bias that is itself shaped culturally (Berl & Hewlett, 2015). One plausible explanation for why German children showed more overimitation than their Namibian counterparts is the role of dyadic, child-centered pedagogy in these populations: German children's overimitation emerges within pedagogical, child-directed interactions and becomes pervasive early in ontogeny. Among both Namibian populations, where children rely more on self-directed, observational learning, children's reliance on overimitation is markedly smaller. Even though this study thus shows that the developmental onsets and the frequency of overimitation vary across populations, it also supports previous studies documenting the flexible use of (over)imitation in populations in which child-directed pedagogy is practiced less frequently (see also Shneidman, Gaskins, & Woodward, 2016).

An alternative explanation for the cross-cultural differences in overimitation may be that, for both Namibian populations, the Western model was perceived as an out-group member. Previous research among Western participants has shown that children copy more actions if the model belongs to the in-group, rather than an out-group (Buttelmann, Zmyj, Daum, & Carpenter, 2013; Gruber, Deschenaux, Frick, & Clément, 2017; Wilks, Kirby, & Nielsen, 2018). Whether and how group affiliation affects imitation outside Western contexts is an important avenue for future research.

In the study by Nielsen and Tomaselli (2010), the authors report comparable levels of overimitation among their participants irrespective of whether actions were modelled by a member of their in-group or not. Berl and Hewlett (2015), however, argue that Western experimenters may actually boost overimitation in some non-Western populations because such models may be perceived as high in social status. To which extent peculiarities of the model increase or lower overimitation in non-Western children needs to be investigated in future studies.

Even though overimitation was lower among both Hai||om and Ovambo than among German children, the current data shows that it was well within their repertoire. One factor that may have driven overimitation across populations is children's exposure to modern schooling and market economy. Such factors are known to alter social learning among children in indigenous communities (Correa-Chávez & Rogoff, 2009) and have previously been hypothesized to shape overimitation (Berl & Hewlett, 2015). To which extent such factors contribute to children's use of overimitation as a social learning strategy needs to be addressed by future research.

These findings support the functional universal hypothesis claiming that children's overimitation is actuated by social motivation even though levels of overimitation may vary across populations (Nielsen, 2008, 2018; Nielsen & Haun, 2016). This does not imply that overimitation only reflects a social motivation to affiliate and interact. Although the current approach to let an adult turn his/her back to the child has recently been shown to be most efficient to trigger social motivation in young children (Marsh et al., 2019), children in this study showed overimitation even when the model was not observing them (see also Lyons et al., 2007).



Furthermore, overimitation has also been found robustly in situations outside experimental contexts in which the model was not present at all (Whiten, Allan, et al., 2016). It is thus likely that other factors, such as cognitive biases (Lyons et al., 2007), contribute to children's overimitation. If so, memory and attentional capabilities might additionally be relevant for deciding whether to overimitate. Reducing task demands (e.g., modelling only one irrelevant action instead of a sequence) may shed light on how such cognitive factors affect overimitation. While this study does not inform about the cognitive biases underlying overimitation, these results suggest that overimitation is robustly actuated by the presence of the model, suggesting a social motivation being relevant for the behavior across diverse populations.

In contrast to other cross-cultural studies on overimitation (Berl & Hewlett, 2015; Nielsen et al., 2014; Nielsen & Tomaselli, 2010), I observed a cross-culturally recurrent increase in children's overimitation with age. Children become more skillful members of their community during middle childhood and may receive child-centered learning opportunities more frequently with increasing age in order to learn more complex behaviors (e.g., Boyette & Hewlett, 2017). This may facilitate the use of overimitation as an adaptive strategy for social learning. The developmental increase in overimitation may further reflect age-related changes in memory capability and/or motor skills. Again, one possible avenue for future research is to investigate whether the effects of age and populations persist once children are confronted with tasks demanding lower cognitive abilities. Notably, Berl and Hewlett (2015) document overimitation in Aka adults even though the behavior was almost absent among young children. Although the accessibility and ontogeny of overimitation vary across

populations, the behavior is principally available and more frequent in the presence of the model across cultural contexts and can thus be considered functionally universal (Norenzayan & Heine, 2005).

This study is, to my knowledge, the first to empirically assess construct validity of the social motivation in overimitation across diverse populations. Overimitation did not predict reengagement behaviors in a separate task, questioning whether the social motivation for interacting with others is what drives overimitation in the presence of the model. In contrast, children may have shown overimitation selectively in order to conform to the model (DiYanni et al., 2015; McGuigan & Robertson, 2015) or to adhere to a perceived social norm (Keupp et al., 2013). Different social demands of the tasks may also explain the missing relation between overimitation and reengagement behaviors. Shy children, for example, may display high levels of social motivation in an overimitation context (e.g., copying the model exactly) in order to obey and because social initiative is not required in such situations. At the same time, they may appear less socially motivated in other contexts (e.g., not reengaging a recalcitrant adult in dyadic interaction) due to social inhibition.

With regard to the reengagement task, the different levels of reengagement across populations need to be handled with caution. The Western experimenter was an out-group member in both Namibian populations. Local habits for approaching out-group members in social activities may thus have also been relevant for the cultural differences observed here. Again, more cross-cultural work is needed to understand whether and how such manipulations affect children's social behaviors. Regardless of the missing relation between both phenomena linked to social

motivation it is important to note that both behaviors were more frequent among German as compared to both Hai||om and Ovambo children. This illustrates the necessity for testing children outside Western contexts in order to draw conclusions about the universality of human behaviors.

In sum, the current study provides novel insights into the ontogeny, function, and universality of children's overimitation. Children in three diverse populations showed a social motivation to overimitate an adult by copying more actions when the model was observing them as compared to being non-observant. Although it may be most common in Western contexts, the function of overimitation is inherently social across diverse cultures.



# 4

## Study 2

### Cultural Variation in How Much, But Not Whether, Children Overimitate<sup>3</sup>



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<sup>3</sup> A research article based on this study has been submitted for review to a scientific journal

## **Abstract**

*Children from Western, industrialized societies tend to copy actions modelled by an adult with high fidelity even if these actions are causally irrelevant. This so-called overimitation has been argued to be an important driver of cumulative cultural learning. However, cross-cultural and developmental evidence on overimitation is controversial, likely due to diverging task demands regarding children's attention and memory capabilities. Here, three- to seven-year-old children from a recent hunter-gatherer society (Hai||om/Namibia) were compared with urban Western children (Germany) using an overimitation procedure with minimal cognitive task demands. While the proportion of children engaging in overimitation at some point during the study was similar across the two populations, German overimitators copied irrelevant actions more persistently across tasks. These results suggest that the influence of culture on children's overimitation may be one of degree, rather than of kind.*

## Introduction

Imitation is an important social learning strategy that helps children to accumulate knowledge and skills they could never compensate for by innovation alone (Heyes, 2012a; Legare & Nielsen, 2015). From their second year of life onwards, children start to imitate actions which are visibly irrelevant for achieving an instrumental goal. This so-called overimitation (Horner & Whiten, 2005; Lyons et al., 2007) has been suggested as a pervasive driver of cultural learning among humans (Legare & Nielsen, 2015; Legare, Wen, Herrmann, & Whitehouse, 2015; Nielsen, 2012; Over & Carpenter, 2013), as it allows the transmission of ritual-like behaviors that display affiliation with group members. If so, one would expect that overimitation is universal across a broad range of cultural contexts. Of particular relevance for understanding the significance of overimitation in social learning is the cultural context of contemporary hunter-gatherers, given that this form of subsistence most closely resembles the social organization under which modern humans evolved.

However, only few studies have assessed overimitation among hunter-gatherer populations. Evidence taken from these studies is contradictory with regards to whether and how much hunter-gatherer children overimitate (Berl & Hewlett, 2015; Nielsen et al., 2014; Nielsen & Tomaselli, 2010). Initial cross-cultural studies documented similar rates of overimitation among children from South-African hunter-gatherer populations as compared to urban children from urban Western populations (Nielsen & Tomaselli, 2010; Nielsen et al., 2014, 2016). Accordingly, the authors hypothesized overimitation as a “universal human trait” (Nielsen & Tomaselli, 2010, p. 1) that drives social learning across cultural contexts (Legare &

Nielsen, 2015; Nielsen, 2018). Recent findings challenged this assumption by documenting considerable variation in overimitation among hunter-gatherer children. While children from an Aka hunter-gatherer community in the Central African Republic showed almost no overimitation at all, adults from the same community did so more frequently (Berl & Hewlett, 2015). In support of a more gradual difference between Western children and those from a more traditional hunter-gatherer community, rural Hai||om children from Namibia showed less overimitation than urban Germans (see study 1, this dissertation). Given these findings, the universal importance of overimitation for social learning is at question.

To fully understand the evolutionary significance of overimitation on shaping social learning in human populations, developmental approaches are important to understand when and how the behavior is acquired throughout ontogeny (Apicella & Barrett, 2016; Liebal & Haun, 2018). Again, recent evidence is inconsistent. In Western, industrialized societies, children's overimitation typically increases from their second year of life onwards (Clay et al., 2018; Lyons et al., 2007; McGuigan et al., 2011). Among non-Western societies, the evidence for such a developmental trajectory is mixed. In study 1 of this dissertation, I found an age-related increase in children's overimitation across four- to eight-year-old Hai||om children. In contrast, Berl and Hewlett (2015) report no developmental increase in overimitation among Aka hunter-gatherer children of similar ages. Aka adults, however, showed overimitation more persistently. Other cross-cultural studies did not find age-related increases in overimitation among hunter-gatherer populations (Nielsen et al., 2014, 2016; Nielsen & Tomaselli, 2010).



Several aspects have been discussed as potential drivers of these inconsistencies in cross-cultural and developmental evidence on overimitation. First, cognitive and attentional task demands may have led children from Western communities to overimitate at higher levels than their non-Western counterparts, while also fostering age-related increases in some studies. In most overimitation tasks described previously, sequences of irrelevant actions have to be noticed, remembered, and exhibited in order to score high on overimitation. Western pedagogy may have helped those children to recall every irrelevant action, whereas the comparably low levels of direct pedagogy among hunter-gatherer children (Boyette & Hewlett, 2017) may have resulted in a lower focus on these actions among participants. Second, children's exposition to functionally opaque artifacts, such as novel toys, may further explain cultural differences (Berl & Hewlett, 2015). In a typical overimitation paradigm, children are exposed to transparent boxes from which they then are given the opportunity to obtain rewards themselves. While Western children may have learned that even such objects may reveal hidden functions that are not visible at first glance (e.g., electronic sounds), children with less exposure to such artefacts may have little reason to expect such functions (Berl & Hewlett, 2015). Third, typical instructions, such as "your turn!" (Berl & Hewlett, 2015; Nielsen & Tomaselli, 2010) and "now you!" (see study 1) may have been perceived as a pedagogical request for imitation selectively in Western populations where such instructions are common. Fourth, characteristics of the model may have driven overimitation whenever Western experimenters conducted studies with non-Western participants (see also Berl & Hewlett, 2015). Finally, the variety of tasks used to assess overimitation is immense

(Hoehl et al., 2019). Depending on the specific procedure and coding scheme, overimitation scores may either reflect participants' tendency to show overimitation at all (*whether* overimitation occurs per se; e.g., Berl & Hewlett, 2015) or how accurate and persistent they would do so (*how much* individuals rely on overimitation, e.g., see study 1).

Accounting for these explanations, I designed a set of overimitation tasks with limited task demands. I kept normative language at minimum and actions were modelled by local experimenters. I investigated three- to seven-years-old children from a contemporary hunter-gatherer population (Hai||om/Namibia) and a Western, urban community (Germany). I used transparent lunch boxes from local shops in Namibia to minimize object novelty for the Hai||om children. I assessed four different tasks, each involving only one irrelevant action to minimize effects of task demands on children's overimitation and in order to give children four independent choices in choosing whether and how persistently to overimitate.

Following previous cross-cultural work (Berl & Hewlett, 2015; study 1 of this dissertation), I expected German children to show more overimitation than their Hai||om counterparts. If so, an exploratory question was whether such differences would manifest in *whether* or *how much* children would overimitate across the tasks. If the developmental increase observed in study 1 was due to an age-related increase in the social motivation for overimitation, I would expect children to show increasing levels of overimitation in both kind and persistence. In contrast, the absence of age effects would indicate that task demands, rather than an increasing reliance on overimitation, were driving such effects in previous studies.

## Methods

### *Participants*

42 Hai||om children were tested in Ondera ( $M_{Age} = 6.06$  years, range = 3.58 – 7.76, 21 girls) and 80 German children in Leipzig ( $M_{Age} = 5.77$  years, range = 3.54 – 7.40, 40 girls) in the experimental condition. An additional 20 children of similar ages (10 per population) were tested in a control setup to assess whether children would show the irrelevant actions without observing a model performing them. The study was conducted at local school buildings.

### *Materials*

Children were confronted with four boxes from which they could obtain candy (skittles; one per box). First, a transparent box (length = 10cm, width = 10cm, height = 5cm) with a transparent cover, having four flaps unfolded, was used together with a red pen (length = 17cm; see Figure 3a). Second, I used a brown cylindrical box (diameter = 7cm; height = 10cm) with a transparent cover (see Figure 3b). Third, a transparent box (length = 8cm, width = 11cm, height = 11cm) with a green-transparent cover and a lid covering a top hole was used (see Figure 3c). Finally, a blue box (length = 10cm, width = 29cm, height = 4cm) with 14 indentations and a white plastic spoon (length = 12cm) were presented to the participants (see Figure 3d). All boxes were ordinary containers designed for storing food and were bought in local shops in Namibia. Instructions were given in children's respective native language. Translations and back-translation of the instructions were done by two independent native speakers. No disagreements occurred between translators.

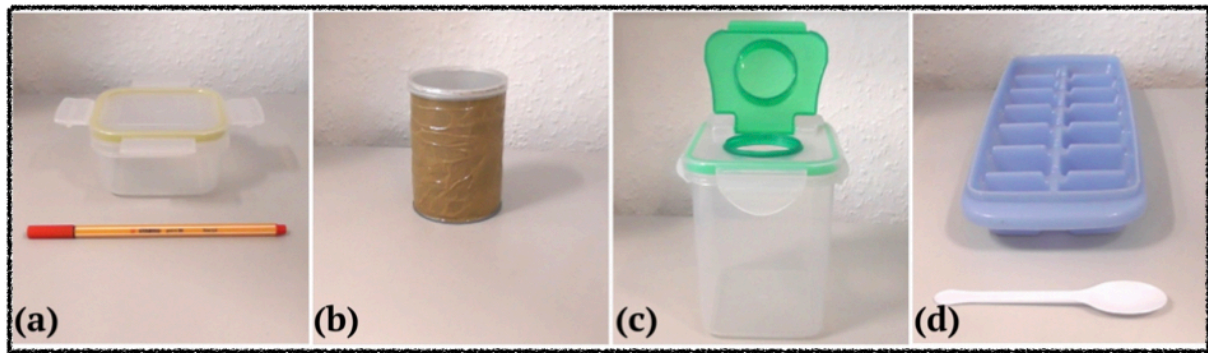


Figure 3. Overimitation boxes used in the study

### ***Procedure***

Children entered the study room together with a male experimenter. First, both child and experimenter sat down facing each other at approximately 1m distance. The experimenter took a paper bag and stated that both of them could use these to collect candy for themselves. He then took the first container and placed it between the participant and himself. Now, the experimenter took a candy out of the container and presented it to the child before putting it back into the container. He said “look” to direct the child’s attention toward the container and started with the modelling sequence. He then performed an irrelevant action on the box before obtaining the reward. Now, he took the candy from the box, showed it to the child and put it into his paper bag. Next, he took another candy, showed it to the child and put it into the box. After directing the child’s attention (“look”), he again performed the irrelevant action and took the candy from the box. This time, he showed the candy to the child and put it back into the box. He pushed box and pen within child’s reach and stated: “Now you can take the candy”. After children took the candy, the experimenter took the box aside und introduced the second container. This procedure was repeated 4 times,

allowing children to obtain candy from 4 transparent containers presented in a fixed order.

For the first box, modelled actions included using the pen to tip each flap of the box, circling the box two times (irrelevant) before opening the cover and retrieving the candy (relevant). For the second box, he rattled the box next to his head 4 times (irrelevant) before obtaining the cover and retrieving the reward (relevant). On box three, the experimenter opened and closed the lid three times (irrelevant) before extracting the reward by turning the box upside down (relevant). Finally, the experimenter moved the candy, originally located in the indentation most distant from him, from one indentation to the other using the plastic spoon (irrelevant) and obtained the candy (relevant).

In the control setup, children found themselves in an identical scenario as in the original experiment. Here, the experimenter pushed the boxes within the participant's reach without modelling any action while asking them to take the rewards using identical instructions as in the experimental condition.

### ***Coding***

I coded children's imitative behavior across the four trials. If children replicated the irrelevant action when confronted with a box, they received a score of 1. If they opened the box without performing the irrelevant action, they received a score of 0. A sum score was calculated by adding children's scores per task resulting in an overimitation score between 0 and 4. A research assistant not involved in the study and unaware of the hypotheses coded 20 subjects in each culture. Interrater reliability was perfect ( $\kappa = 1$ ).

### ***Statistical Models and Preliminary Analyses***

In the control setup, no child in either community performed any of the irrelevant actions that were shown during experimental trials. Overimitation in the test situation is thus due to imitation of the model rather than innovation or any other strategy for obtaining the candy. Thus, all statistical analyses exclusively focused on children's behaviors in the experimental condition.

In the statistical model, I wanted to estimate whether children's overimitation would vary with age, population, and the interaction between the two. Further, sex was included as a predictor since previous research has documented boys to overimitate more than girls (Frick, Clément, & Gruber, 2017). To assess *whether* and *how much* children would show overimitation, I ran a zero-inflated model. Since overdispersion was not an issue in the data (*dispersion parameter* = 0.91), the model was run with Poisson error structure. This approach allowed us to investigate the effects of the predictors on the outcome by using two regression analyses in parallel. First, a binomial logistic model estimated whether children's overimitation would differ from zero. Second, a Poisson count model estimated whether the predictors would explain how much children would overimitate. Models were fitted in *R* (R Core Team, 2018) using the function *zeroinfl* from the package *pscl* (Zeileis, Kleiber, & Jackman, 2008). The same predictors were included into both the count- and zero-inflation part of the model. To estimate the impact of each predictor, I compared a model comprising the interaction between the predictors with a model consisting of main effects only using a likelihood-ratio test.

Significance of the predictors was estimated by running likelihood-ratio tests comparing the model with a reduced model not containing the respective predictor either in the count or in the zero-inflation part using a function provided by Roger Mundry (personal communication). Since the interaction between age and population did not reach statistical significance, I dropped this term from the model to investigate the main effects of the two predictors.

## Results

Overall, German children ( $M = 2.46$ ,  $SD = 1.76$ ) overimitated more persistently than Hai||om children ( $M = 1.57$ ,  $SD = 1.56$ ; count model:  $\chi^2(1) = 9.93$ ,  $p = .002$ ). However, population did not predict whether children would show overimitation per se (zero-inflation model:  $\chi^2(1) = .06$ ,  $p = .801$ ; see Figure 4a). The likelihood of whether children would show overimitation at least once was similar across communities (Hai||om: 31/42, 74%; German: 59/80, 74%). However, more than half of the German children showed overimitation in all four tasks (41/80), whereas only about one fourth of Hai||om children did so (10/42). Among Hai||om, the most common behavior was to show overimitation in only one of the four tasks (14/42), while such low persistence on overimitation was rarely observed among German children (9/80). The majority of German children showed overimitation across all tasks, whereas most Hai||om children did so only during tasks 1 and 4 (see Figure 4b). Age did neither affect whether (zero-inflation model:  $\chi^2(1) = 0.29$ ,  $p = .589$ ) nor how much (count model:  $\chi^2(1) = 0.27$ ,  $p = .605$ ) children showed overimitation.

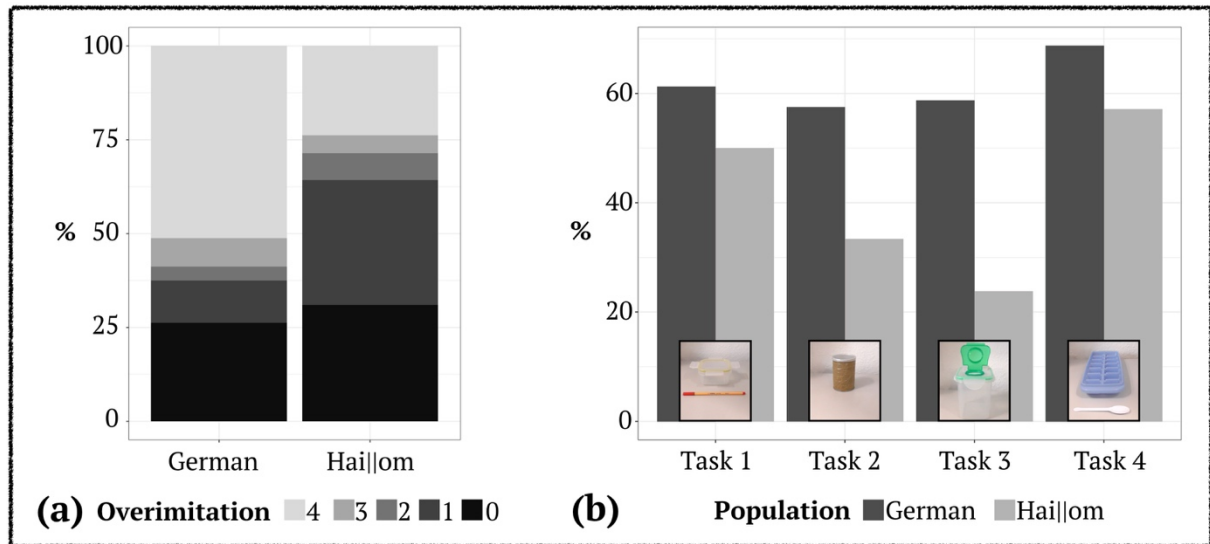


Figure 4. Overimitation across populations; a) Overimitation per population (%); b) Overimitation per task and population (%)

## Discussion

In this study, I investigated cross-cultural differences in children's overimitation. I minimized cognitive and attentional task demands, introduced familiar objects, and gave instrumental instructions by local experimenters to optimize comparability across populations. Under these circumstances, children's overimitation did not vary across ages. German children showed overimitation more persistently than Hai||om children, which replicates previously documented differences between urban Western and rural hunter-gatherer children (Berl & Hewlett, 2015). Importantly, this does not imply that overimitation did not occur among Hai||om children. The difference between children across cultures was in how much, not whether, children would show overimitation during the study.

More than half of the German participants showed overimitation in all four tasks. In contrast, only about one in four Hai||om children overimitated with similar



persistence. At first glance, these results support claims on overimitation as a by-product of Western pedagogy rather than an evolutionary commonality among humans (Berl & Hewlett, 2015). However, overimitation was clearly within the behavioral repertoire of most children in either population. In both populations, around three out of four children overimitated at least once throughout the study. Accordingly, interindividual variation was substantial: Around a quarter of the children in either population showed emulation instead of overimitation across tasks by retrieving the rewards without copying irrelevant actions at all. It thus appears that, even though absolute rates of overimitation and emulation vary between populations, the variation within populations may be cross-culturally recurrent. Interestingly, such stable ratios in social learning strategies on population levels may be functionally adaptive for the group as a whole (Yu & Kushnir, 2019). Accordingly, establishing and maintaining cumulative culture requires that faithful imitation (e.g., overimitation) and novel behaviors (e.g., innovation, emulation) are kept in balance. More research is needed to understand why some children engage in overimitation persistently, occasionally, or not at all. Personal dispositions, such as children's social motivation to affiliate (Nielsen & Blank, 2011) and conformity (DiYanni et al., 2011) are promising candidates to interact with cultural input in shaping children's preferred strategies for when and how to learn from others.

The current data suggests that children across cultures differ in how much, but not whether, they engage in overimitation. Hai||om children can and do engage in overimitation. The persistence and ubiquity of overimitation among Western contexts may, however, lead to an overestimation of its relevance outside such populations.

Other strategies, such as observation, emulation, and learning through trial-and-error, do also contribute to when and how individuals acquire skills and knowledge (Hewlett, 2016). Taken together, I thus argue that the capacity for and use of overimitation in pedagogical settings is shared across cultures and consequently functionally universal (Norenzayan & Heine, 2005).

Most German children showed overimitation pervasively. Hai||om children, in contrast, did so only selectively. Five Hai||om children showed overimitation on trial 1 but ceased to do so afterwards. Eight children showed overimitation only in trial 4. Notably, in both of these trials, a tool (trial 1: pen; trial 4: plastic spoon) was used for performing the irrelevant action. Recent research suggests that using tools increases overimitation in children (Taniguchi & Sanefuji, 2017), making it plausible that overimitation is particularly prevalent during the acquisition of behaviors involving tool-use. Interestingly, anthropologists have described teaching among hunter-gatherers to occur primarily in the acquisition of complex and/or social skills (Boyette & Hewlett, 2017; Salali et al., 2019). It is thus plausible that the dyadic, child-centered context in which overimitation was assessed in this study triggered overimitation among the Hai||om participants because they expected the model to display complex or socially-important information (such as rituals or norms; see Csibra & Gergely, 2009, 2011). Realizing that the actions were neither complex nor socially meaningful, they may have switched to emulation instead. German children at the age range tested here may increasingly overgeneralize overimitation as a useful strategy due to the ubiquity of direct, child-centered pedagogy in their daily lives.

In contrast to other studies (Berl & Hewlett, 2015; Lyons et al., 2007; McGuigan et al., 2011; Nielsen, 2006), children's overimitation did not increase with age. This result is surprising because such an effect was previously shown in Hai||om children from a neighboring community (see study 1 of this dissertation). The developmental stability in overimitation once cognitive and attentional task demands are lowered indicates that children's inclination for overimitation is acquired early in ontogeny and may remain more stable than thought previously. Future studies will need to assess children's cognitive abilities (e.g., memory skills or executive functioning) and their social motivation in parallel in order to disentangle the effects of both variables on triggering whether and how much children overimitate.

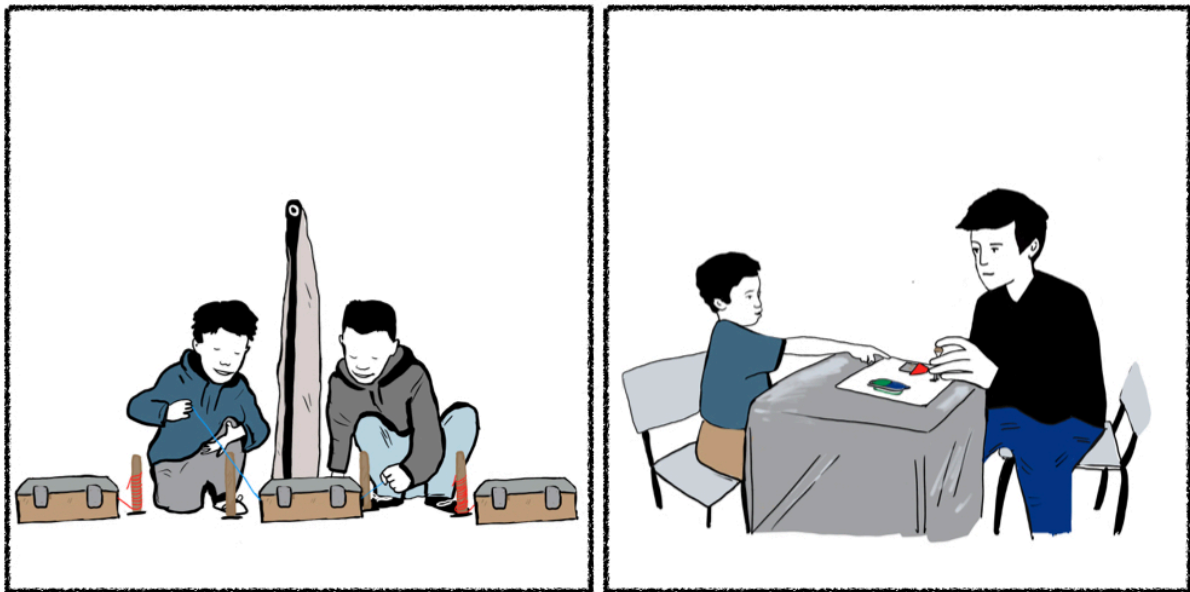
In sum, this study argues that it is the persistence on, rather than the capacity for, overimitation that is shaped culturally. German children engaged in more overimitation than Hai||om children, even though task demands were kept minimal. Compared to their Western counterparts, it thus seems that rural hunter-gatherer children flexibly use overimitation as one out of many strategies for learning from others, whereas urban Western children may tend to overimitate more persistently.



# 5

## Study 3

### Collaboration and Theory of Mind in Three Diverse Populations<sup>4</sup>



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<sup>4</sup> A research article based on this study has been submitted for review to a scientific journal

## **Abstract**

*Children's social motivation to interact with peers is hypothesized to boost the frequency and quality of social interactions and, in consequence, their emerging Theory of Mind. I investigated three- to eight-years-old children's social motivation and social-cognitive skills in three diverse populations (German, Hai||om, Ovambo; N=240). In all three populations, children displayed more positive emotions during collaborative as compared to individual activity. In contrast, the preference to collaborate or to work alone varied across populations: German children preferred collaboration, whereas Hai||om children chose individual over collaborative activity. While younger Ovambo children preferred collaboration, they favored individual activities increasingly with age. Crucially, at an individual level, children's positive emotions during collaboration predicted their Theory of Mind skills in a separate task. These results indicate that while cultural context strongly shapes children's explicit choices whether to collaborate with peers, the positive emotions accompanying collaboration may be a cross-culturally recurrent driver of social-cognitive development.*

## Introduction

Ranging from small hunter-gatherer bands to industrialized urban societies—humans depend on social interactions with others (Henrich, 2015). Consequently, children need to learn how to navigate and benefit from social interactions with adults and peers. For this learning process, collaborative interactions, in which two or more agents are interdependently working toward a joint goal for mutual benefit, are particularly relevant. The interdependence between collaborating agents demands mental perspective-taking and coordination, because individuals have to monitor and adapt their own actions, perspectives, beliefs, and goals with those of their interactants (Chevallier et al., 2012; Tomasello, 2018). Engaging in collaboration thus offers a unique learning context for Theory of Mind.

It has been suggested that the early emergence of collaboration in human ontogeny relies on children's intrinsic motivation to interact (Chevallier et al., 2012; Levinson, 2006; Tomasello et al., 2005). In support of this claim, four- to eleven-year-old U.S.-children display more positive emotions (e.g., intensity and frequency of smiles) when solving problems in collaboration with a peer as compared to doing so individually (Perlmutter et al., 1989). Furthermore, three-year-olds from urban Germany prefer to work collaboratively in contrast to solitarily in order to obtain rewards (Rekers et al., 2011).

Thus far, the social motivation underlying children's collaboration has almost exclusively been studied in Western, industrialized populations. This sampling bias renders generalizations about the motivational underpinnings of children's social interactions inadequate (Henrich et al., 2010; Nielsen et al., 2017). In Western

societies, children's social interactions are typically scaffolded by parents and other caregivers. Adults support children's learning from and within social interactions by praising them for socially competent behaviors. Children are free to approach others depending on their preferences (Keller, 2007). Children learn to collaborate with others under adult supervision (Brownell et al., 2006; Tomasello & Hamann, 2012). By the age of two years, they begin to flexibly coordinate activities themselves and increasingly engage in peer collaboration without adult supervision (Brownell et al., 2006; Eckerman, Davis, & Didow, 1989). From this age onwards, peer collaboration is ubiquitous in children's everyday social interactions in Western, industrialized societies.

However, this practice to actively shape and reward children's social interactions with peers is not representative for children's socialization outside urban Western populations. In traditional farming communities, for example, parents neither routinely engage in collaborative activities with their children, nor do they supervise or reward children's peer interactions in the way Western parents do. Instead, caregivers value hierarchical relatedness, obedience, and conformity (Barry et al., 1959; Keller & Kärtner, 2013). The Ovambo, an ethnic group of Namibian agro-pastoralists, emphasize these values in their socialization goals and practices (Brown, 2011; Nampala et al., 2006; Zimba, 2002): Children's dependence on and relatedness to the social group is emphasized using directive, assertive communication between parents and their offspring (Brown, 2011; Keller, 2007). Even young children are frequently tasked with household duties and are required to do so autonomously and without the help of others. Peer interactions are rarely supervised by adults.



In hunter-gatherer communities, such as the Hai||om of northern Namibia, caregivers value autonomy as a primary socialization goal (Hewlett, 2016; Widlok, 1999). In such contexts, children are free to structure their activities without strong obligations toward others, enabling higher levels of individual, rather than collaborative learning. Adults and children actively avoid subordination and dependence between individuals (Boyette & Hewlett, 2017). Similar to the Ovambo, receiving direct instruction and supervised collaboration from adults is rare among Hai||om parents because such parenting contradicts cultural emphasizes on egalitarianism and autonomy. In contrast to Western parenting practices, caregivers rarely praise young children for socially competent behaviors but rather rebuke them when children do not adhere to social norms (Boyette & Hewlett, 2017; Terashima & Hewlett, 2016).

In sum, there is strong evidence that the quality and quantity of young children's social interactions and collaboration activities differs substantially across populations. It is, however, unclear whether and how such differences also affect children's motivation to engage in social interactions. Given the importance of social motivation for fostering children's social-cognitive development (Carpendale & Lewis, 2004; Chevallier et al., 2012; Tomasello, 2018; Tomasello et al., 2005), it is also unclear whether this link can be generalized as a cross-culturally recurrent mechanism in children's social-cognitive development. Finally, the exact determinants and construct validity of children's social motivation are currently unclear. Various measures have been put forward as proxies for children's social motivation, including their positive emotional expressions (Aknin et al., 2012;

Perlmutter et al., 1989) and their preferential choices (Rekers et al., 2011; Schuhmacher & Kärtner, 2015). Whether these phenomena are reflective of the same underlying motivation or whether they indicate distinct, unrelated components of reward processing (Berridge & Robinson, 2003) has yet to be examined.

To address these issues, I assessed three- to eight-year-olds' social motivation for collaboration utilizing both their emotional expressions and their more explicit preferential choices. To account for the role of culture in shaping children's social interactions, I tested participants from an urban German population (Leipzig) and children from two rural and culturally-diverse Namibian populations (Hai||om, Ovambo). Dyads of children (matched for sex and age) played a game in which they could obtain balls from three apparatuses by pulling ropes. In a within-subject design, children retrieved the balls either through individual action or through collaborative efforts with their peer (eight trials in total). As a first measure of children's social motivation, their positive emotional expressions during each activity were coded from video. In addition to gaming context (individual or collaborative), I manipulated the objective value of the balls (high reward or low reward). This was done to validate whether the coding scheme could reliably identify changes in children's emotional expressions as a function of objective rewards. As a second measure of social motivation, I investigated their explicit preferences by letting them choose to play either individually or collaboratively in a final trial.

To assess whether interindividual differences in children's social motivation for collaboration would relate to their social-cognitive abilities, participants also completed a culturally adapted Theory of Mind scale in a separate task (Wellman &

Liu, 2004) in which they were asked questions about the mental states of fictive characters. A composite score of children's performances across tasks was used as a proxy for their Theory of Mind skills.

I hypothesized that if children's social motivation to collaborate is a universal driver of social interactions, children across all three populations should be biased to express more positive emotions during collaboration as well as to prefer collaboration during the subsequent forced-choice trial. If, in contrast, this motivation is culturally variable, the three populations should show different patterns: German children should show high social motivation due to the parental scaffolding of collaborative behaviors and the praise received in social interactions (Perlmutter et al., 1989; Rekers et al., 2011). Hai||om children, in contrast, should show a lower (or even reversed) motivation to collaborate due to their cultural emphasis on child autonomy (Boyette & Hewlett, 2017). My expectations regarding Ovambo children were mixed. On the one hand, the limited supervision and praise for socially competent behaviors by Ovambo caregivers might reveal a similar pattern as predicted for Hai||om children. On the other hand, the local emphasis on interpersonal responsibilities and social relations might also foster children's motivation to collaborate. In the case of revealing cross-cultural variability in children's social motivation, I further predicted that such differences should become more pronounced with increasing age (Blake et al., 2015; House et al., 2013). With regard to the construct validity of social motivation across measurements, I further expected children's positive expressed emotions during collaboration to predict their preferential choice in a subsequent forced-choice trial because of the increased reward value of collaboration following positive

experience with their peers (see also Schuhmacher & Kärtner, 2015). To further explore this potential effect, I was also interested in whether such links between socially motivated behaviors would be affected by children's age and their cultural background. Finally, I expected interindividual differences in both positive emotional expressions and explicit choices to be linked to children's Theory of Mind regardless of population and age, since the interplay between social motivation and social cognition has been assumed to be universal across populations (Chevallier et al., 2012; Tomasello, 2018).

## Methods

### *Participants*

A total of 240 children (120 dyads,  $M_{Age} = 5.87$  years,  $SD_{Age} = 1.18$ , age range = 3.54 to 8.35) participated in the study. Each participant was paired with a same-sex peer of approximately similar age ( $M_{Age\ Difference} = 0.45$  years,  $SD_{Age\ Difference} = 0.58$ ). Participants came from three different populations: Forty German dyads ( $n = 80$ , 42 girls,  $M_{Age} = 5.77$ ,  $SD_{Age} = 1.22$ ,  $M_{Age\ Difference} = 0.30$ ) from Leipzig, 40 Hai||om dyads ( $n = 80$ , 40 girls,  $M_{Age} = 6.11$  years,  $SD_{Age} = 1.02$ ,  $M_{Age\ Difference} = 0.68$ ) from Ondera and Farm 6, and 40 Ovambo dyads ( $n = 80$ , 38 girls,  $M_{Age} = 5.73$  years,  $SD_{Age} = 1.26$ ,  $M_{Age\ Difference} = 0.37$ ) from Oshivelo. Five additional dyads were tested in Oshivelo but excluded from further analyses because children were later found to be older than the initially targeted maximum age of 8 years (3 dyads) or because one or both children were later found growing up in a non-Ovambo household (2 dyads). Among Hai||om participants, one additional dyad did not finish the study because of reluctance.

## **Materials**

**Collaboration task.** Each child sat on a cushion (diameter = 34cm) placed on the floor in approximately 2m distance from the apparatuses. Instructions came from a 35-slide multimedia presentation (Microsoft PowerPoint) that was presented on a laptop screen (MacBook Air, 13"). Audio-files were translated from English into the respective language (Oshivambo, Hai||om, and German) by native speakers and the translation was double-checked by another native speaker. Disagreements between translations were minor and were solved through discussion among the two translators. Audio files of the final translations were subsequently recorded and embedded in the videos. The arrangement of apparatuses presented on the laptop screen was identical to that in testing room. Two types of wooden apparatuses (30cm x 15cm x 11cm) were used to manipulate either collaborative or individual efforts for obtaining rewards (following Hamann et al., 2011). Within each apparatus, children could move a wooden block (5cm x 10cm x 5cm; colored either blue or red) by pulling a same-colored rope to release a ball down a ramp. For the two individual apparatuses used in the study, each participant could retrieve one ball by pulling the rope individually. Both ends of the rope were accessible on the collaboration apparatus, so that participants needed to pull together, each on one end of the rope, to retrieve balls. On both types of apparatuses, the ends of each rope were wound around a wooden stick (height = 16cm) in front of the apparatus. Two types of balls (diameter = 3cm) were used as rewards in the study: High-rewarding balls were colorful (red or blue) with rattling plastic balls inside a transparent and shiny round cover. Low-rewarding balls were plain wooden balls with similar colors. Participants could drop the balls into

different types of containers. Children could place the low-rewarding balls in a green plastic box (10cm x 6cm x 4cm) and put the high-rewarding balls into the snout of a golden colored toy elephant, producing attractive jingle sounds. A white curtain (70cm x 70cm), placed in central position in front of the apparatuses, was used as a visual barrier between participants.

***Theory of Mind.*** I used an adaption of the original five-point scale (Wellman & Liu, 2004) to assess Theory of Mind in children across populations. This scale includes tasks on the concepts of Diverse Desires, Knowledge Access, Contents False Belief, Diverse Beliefs, and Hidden Emotions. Children were also tested with an additional task on Explicit False Belief. However, due to an experimental error in one population, I did not include data on this task in the statistical analyses but used the original five-point scale instead. I adapted the original scale as outlined below to meet the requirements of cross-cultural research. All modifications closely mirrored the original equivalent. Only minor changes in stimulus material were implemented to guarantee cultural appropriateness and familiarity.

I used toy figurines with common appearance and names for each population. In the task on Diverse Desires, I implemented images of nuts and candy. For the task on Knowledge Access, I used a matchbox as a container and a toy cat as further stimulus material. I further utilized an empty fish tin as a container to test Contents False Belief together with a cow figure. To assess Diverse Beliefs, I used comic images of a green bush and a wooden hut. I assessed Hidden Emotion using the original emotion scale (Wellman & Liu, 2004) as well as drawings of the back view of a child. Native speakers translated all task instructions and questions from English into each

language. Another native speaker double-checked these translations. Disagreements were minor and were resolved through discussion between translators.

### ***Procedure***

***Collaboration task: Training trials.*** Participants entered the study room with an adult male experimenter and sat down on the cushion next to a laptop from which instruction were given. Children were told that they could obtain balls from apparatuses. Next, they saw how low-rewarding balls could be dropped into the respective container. Each child received a low-rewarding ball to put it into the container herself. The same procedure was repeated for high-rewarding balls afterwards. In the following video sequence, an adult model appeared next to the left individual apparatus and received a low-rewarding ball from it by unravelling and pulling the rope individually. A similar video started in which a second adult model retrieved a low-rewarding ball from the right individual apparatus. Each child could practice the retrieval of balls from the two apparatuses themselves. Subsequently, children saw both models on the laptop screen acting in the collaboration condition. Each model unraveled the rope before both pulled the rope collaboratively. Again, children could retrieve the balls from the collaboration apparatus themselves.

***Collaboration task: Test trials.*** Following training trials, each dyad engaged in eight test trials. The first four test trials consisted each of a combination of reward (high vs. low) and condition (individual vs. collaboration), presented in a counterbalanced order. The order of conditions was then repeated for test trials five to eight. Each child thus participated in each scenario twice during the test phase. Every trial was introduced by a video in which children were explicitly informed about

the next trial. Participants then saw a video sequence showing a model retrieving the ball either alone or collaboratively, depending on condition. Meanwhile, the experimenter baited the apparatuses allowing children to be confronted with a similar situation to that previously seen on the laptop screen. Besides baiting the apparatuses, the experimenter kept interactions with participants at minimum throughout the study. During individual trials, only one individual apparatus was baited at a time and participants thus pulled one after another. Here, the left apparatus was always baited first to avoid confusion in participants.

***Collaboration task: Forced-choice trial.*** After eight test trials, a last forced-choice trial was announced from tape. The experimenter baited all apparatuses with high-reward balls. Children decided on their own whether to retrieve a ball from either the collaborative or the individual apparatus. Each action resulted in a similar outcome and children were free to talk to each other to coordinate their behaviors. Following this trial, children received candy (Skittles) for their participation (see Figure 5 for illustrations of the experimental set-up).



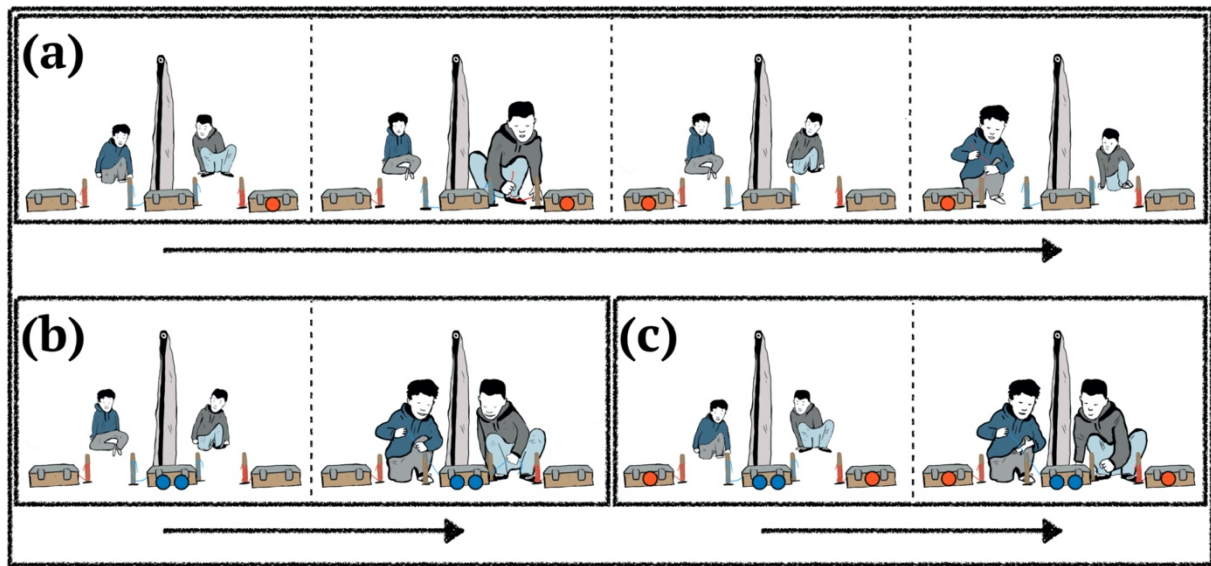


Figure 5. Experimental set-up, baited apparatuses are marked with rewards of respective color; (a) individual trials; (b) collaboration trials; in the beginning of each trial children sit next to each other facing the apparatuses, depending on condition, one (a) or both (b) participants then move toward the apparatuses and pull the rope(s) either alone or collaboratively; (c) forced-choice trial with all apparatuses baited (here: both participants choose collaboration)

**Theory of Mind.** Task manipulation and coding instructions were similar to the original study of Wellman and Liu (2004). Tasks were introduced to children in a fixed order (Diverse Desires — Knowledge Access — Contents False Belief — Diverse Beliefs — Hidden Emotions). Children were tested individually. Children were sitting on a chair next to the experimenter. Study materials were presented on a table between child and experimenter. Assessments of Theory of Mind and social motivation were conducted with a maximal delay of 30 days for each child.

## **Coding**

**Collaboration Task: Positive Emotional Expressions.** Children's behavior was recorded using a camcorder placed approximately 1.5m in front of the apparatuses. For coding children's emotional expressions, videos were cut for each test trial separately. Each such sequence began when children started moving to the apparatus and the video sequence lasted until children picked up their respective ball. One video sequence was approximately ten seconds in duration and was coded without sound. I coded each video with regards to children's most positive expressed emotions in the situation on a scale from 0 (neutral affect) to +4 (super happy). Using similar approaches, previous research reports good to excellent interrater-reliability between raters from different populations (Aknin et al., 2015), since display rules of happiness are performed and recognized robustly and reliably across cultural contexts (Crivelli et al., 2016). Such ratings from tape are also reported to correlate almost perfectly with those of other, standardized measurements for affect, such as Baby FACS (Oster, 2006). Initially, I also implemented a code of -1 (negative affect) in the coding scheme, but did not make use of this because participants did not show signs of such negative affect during test trials. Statistical analyses and data illustrations are thus given in the range from 0 to 4. A second German coder, blind to hypotheses, coded a randomly selected sample of 20 participants per population (25% of the full data). Interrater reliability for the affect data was high ( $ICC = .73$ ).

**Collaboration Task: Forced-Choice Preferences.** Finally, I coded children's behavior on the forced-choice trial as a categorical variable. When deciding to pull individually, children received a score of 0. When choosing the collaboration

apparatus, children received a score of 1. If children tried to pull both ropes simultaneously, they were scored as 0.5. Reliability of the coding system assessing forced-choice preferences was excellent ( $\kappa = .94$ ).

**Theory of Mind.** To code children's Theory of Mind, children's behaviors and verbal utterances were first transcribed. From these transcriptions and the matching videos, each task was rated one by one according to the coding instructions of the original task battery (Wellman & Liu, 2004). That is, children's correct answers were scored as 1, whereas incorrect answers were scored as 0. I calculated a Theory of Mind score by adding all correct answers in the tasks on Diverse Desires, Knowledge Access, Contents False Belief, Diverse Belief, and Hidden Emotions. Children could thus gain a Theory of Mind score between 0 and 5, with higher scores indicating better Theory of Mind abilities. A second coder rated all transcriptions. Interrater agreements were excellent both on task level ( $\kappa_{\text{Diverse Desires}} = .95$ ;  $\kappa_{\text{Knowledge Access}} = .95$ ;  $\kappa_{\text{Contents False Beliefs}} = .90$ ;  $\kappa_{\text{Diverse Beliefs}} = .97$ ;  $\kappa_{\text{Hidden Emotions}} = .96$ ) and with regards to overall Theory of Mind score ( $ICC = .98$ ).

### ***Statistical Models and Preliminary Analyses***

I analyzed the data in *R* (R Core Team, 2018) and the statistical analyses can be grouped into three separate parts. To analyze children's social motivation across populations, I ran models on children's emotional expressions (Model 1) and their forced-choice decisions (Model 2). I further investigated whether children's Theory of Mind abilities could be predicted by children's emotional expressions and their forced-choice decisions (Model 3). I fitted the models using the package *lme4* (Bates et al., 2017) and tested statistical significance of the predictors by using likelihood

ratio tests comparing the full model to a reduced model not containing the respective predictor. Each effect is described by reporting means and standard deviations for each level of the categorical predictors or by naming model estimates and standard errors for each metric predictor. Interactions between predictors were tested but excluded if they did not reach statistical significance. In order to control for the effects of the experimentally controlled variables color of apparatuses (red vs. blue), position of participant (left vs. right), and trial (1–4; z-standardized), I ran pre-analyses with models containing these control variables as predictors. Whenever these variables had a marginally significant effect on the outcome ( $p < .1$ ), they were included into the final model as a control variable. All assumption checks including variance-inflation-factor, normality distribution of residuals (for the linear models), and overdispersion revealed no issues for any of the three models.

***Collaboration Task: Positive Emotional Expressions.*** I investigated whether participants expressed different degrees of positive affect after retrieving the balls depending on population, condition, reward, and age (z-standardized) by calculating a linear mixed model with Gaussian error distribution. I averaged both trials of each combination of reward (high vs. low) and condition (collaboration vs. individual) as a dependent variable to get a reliable indicator of children's emotional expressions across experimental manipulations. Sex was included as a control variable. A prior analysis showed that trial, position of the child, and color of collaboration apparatus were marginally related to children's affect ( $\chi^2_{\text{Trial}} (1) = 3.67, p = .055$ ;  $\chi^2_{\text{Position*Population}} (2) = 9.53, p = .008$ ;  $\chi^2_{\text{Color}} (1) = 3.09, p = .079$ ). All variables were thus included in the model as controls. In addition, I included the random effects of condition, reward,

their interaction, and trial for both dyads as well as each subject in the model. Trial was further included as a random intercept. Preliminary analyses revealed that, in contrast to the other predictors, reward did not interact with any other predictor. It was thus included as a main effect into the final model.

**Collaboration Task: Forced-Choice Preferences.** Here, I focused on whether children's behavior during forced-choice trials was influenced by the predictors population, age, and children's positive expressed emotions during collaboration. For this purpose, I calculated an affect index by subtracting participants' mean affect scores across individual trials (high & low reward) from the mean scores of the collaboration trials. An index of 0 thus indicated that children's affect did not vary between conditions. Positive values indicated more positive emotions during collaboration. Negative values indicated more positive emotional expressions when pulling individually. To test the research hypotheses, I ran a generalized linear mixed model with binomial error distribution. Before running the model, those children who did not show a clear preference for either individual activity or collaboration in this trial by pulling both ropes simultaneously were excluded ( $N = 16$ ). The frequency of these choices did not differ between populations ( $n_{\text{German}} = 6$ ;  $n_{\text{Hailom}} = 6$ ;  $n_{\text{Ovambo}} = 4$ ). Sex was included as a control variable. Finally, dyad was included as a random intercept. To test whether children's choices differed from chance level, binomial tests were run for each group separately.

**Theory of Mind.** Running a linear mixed model, I investigated whether children's Theory of Mind could be predicted by their affect index and their forced-choice behaviors in the pulling game. The dependent variable was children's Theory

of Mind scores. Forced-choice decisions and affect index were included as predictors. Further, populations, age (z-standardized), and sex were included as controls. To account for the dyadic situation in which the predictors were assessed, dyad was included as a random intercept.

## Results

**Collaboration Task: Positive Emotional Expressions.** Children across populations showed higher positive affect during collaborative, as compared to individual trials. German children showed the strongest bias for collaboration ( $M_{Collaboration} = 1.68$ ,  $SD_{Collaboration} = 0.76$ ;  $M_{Individual} = 1.21$ ,  $SD_{Individual} = 0.78$ ), followed by Ovambo children ( $M_{Collaboration} = 1.49$ ,  $SD_{Collaboration} = 1.00$ ;  $M_{Individual} = 1.28$ ,  $SD_{Individual} = 0.99$ ). Among Hai||om children, this tendency was markedly smaller ( $M_{Collaboration} = 1.37$ ,  $SD_{Collaboration} = 1.09$ ;  $M_{Individual} = 1.31$ ,  $SD_{Individual} = 1.04$ ; Populations\*Condition:  $\chi^2(2) = 31.61$ ,  $p < .001$ ; see Figure 6).

With age, children tended to show an increasing bias for collaborative activities in their positive affect displays (Condition\*Age:  $\chi^2(1) = 3.84$ ,  $p = .050$ ). Further, there was a main effect of reward in that children displayed more happiness on trials with high rewards ( $M = 1.44$ ,  $SD = 0.97$ ) as compared to trials with low reward ( $M = 1.34$ ,  $SD = 0.95$ ;  $\chi^2(1) = 15.04$ ,  $p < .001$ ).

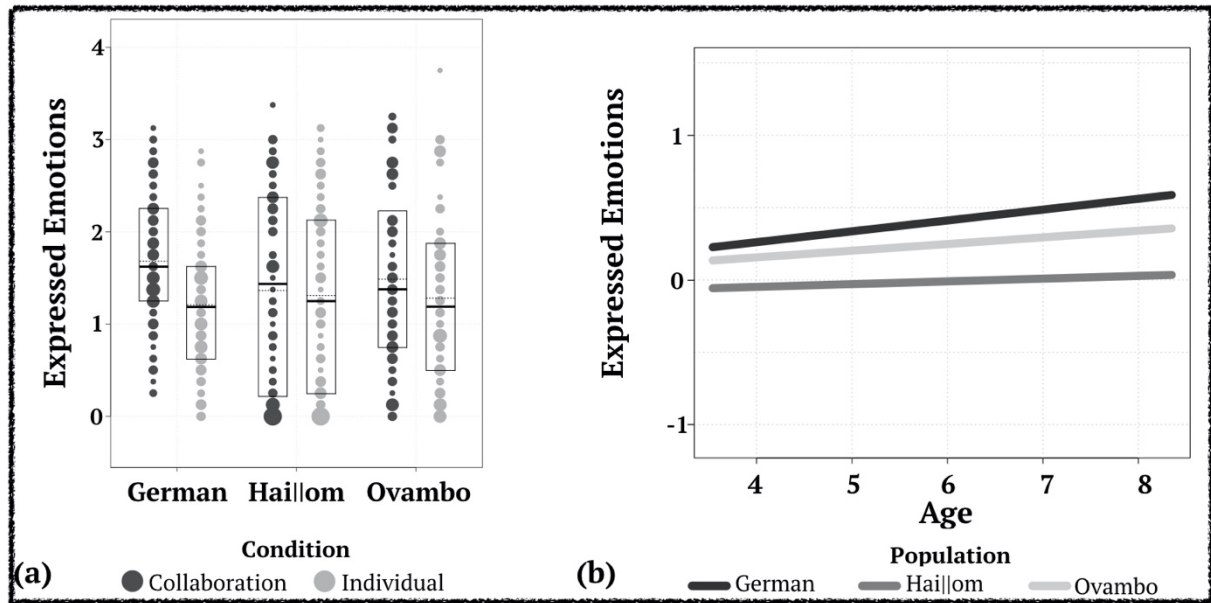


Figure 6. Expressed emotions — (a) effect of population and condition on expressed emotions, bubble sizes are proportional to data points; boxes indicate quartiles; bold horizontal lines indicate group medians; dotted horizontal lines indicate group means; (b) effect of age and population on expressed emotions selectively during collaboration (affect index) (fitted values of Linear Models containing the same predictors and controls as the original model are plotted)

**Collaboration Task: Forced-Choice Preferences.** Across population and ages, children differed in their preferences whether to choose collaboration or individual activity (Population\*Age:  $\chi^2(2) = 9.09$ ,  $p = .011$ ). Only German children showed a preference for collaboration (49/74;  $p = .007$ ). Hai||om children, in contrast, preferred the individual option over collaboration (22/74;  $p < .001$ ). Among both of these populations, these tendencies appeared to consolidate with age (see Figure 7a). Overall, Ovambo children showed no preference for either option (41/76;  $p = .567$ ).

However, while younger Ovambo children preferred collaborative activities, this tendency reversed among older children as those preferably chose to pull individually.

The effect of the affect index on children's preferences varied across ages in that it was only linked positively among younger children, whereas the two proxies of social motivation were dissociated or even linked negatively among older children (Expressed Emotions\*Age:  $\chi^2(1) = 4.43, p = .035$ ; see Figure 7b).

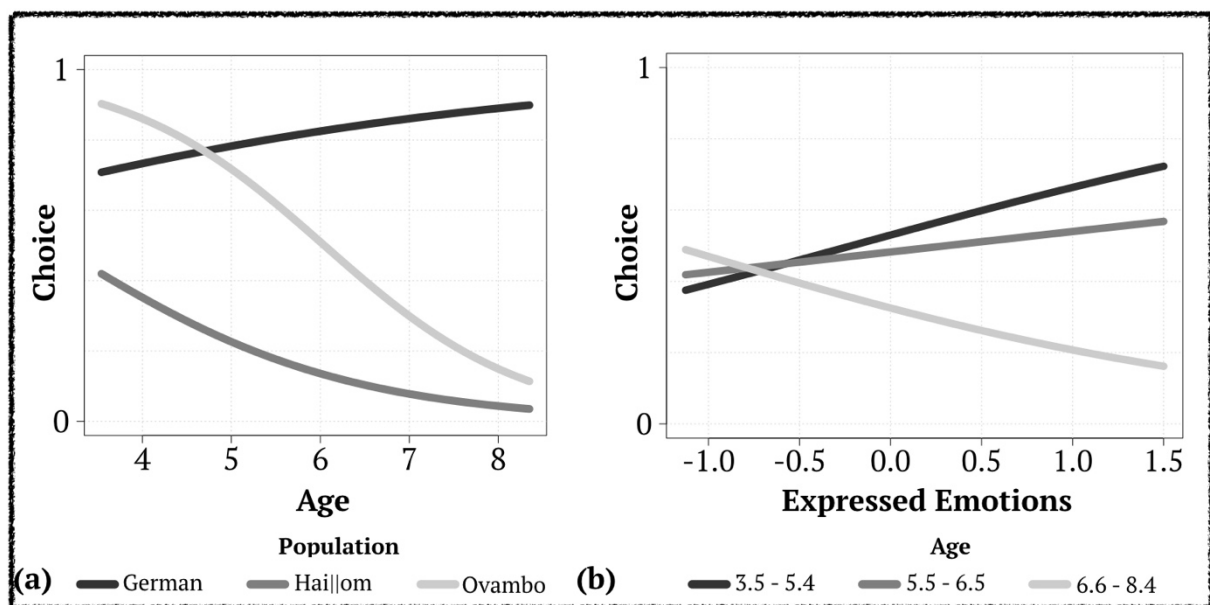


Figure 7. Preferential choices (1 = collaboration, 0 = individual) — (a) effect of age and population on forced-choice decisions (fitted values of Generalized Linear Model containing the same predictors and controls as the original model are plotted); (b) effect of expressed emotions (affect index) on forced-choice decisions (fitted values of Generalized Linear Model containing the same predictors and controls as the original model; for illustrative purposes age was categorized into 3 groups)

**Theory of Mind.** Across populations, children's Theory of Mind skills could be predicted by their emotional expressions ( $\chi^2(1) = 7.60, p = .006$ ). That is, children who



selectively expressed more positive emotions during collaboration as compared to individual activity scored higher on the Theory of Mind scale (Estimate  $\pm$  SE:  $0.41 \pm 0.15$ , see Figure 8). Children who preferentially chose collaboration during forced-choice trials showed considerable, but not significantly higher Theory of Mind skills than those who preferred individual activity ( $M_{\text{Collaboration}} = 2.39$ ,  $SD_{\text{Collaboration}} = 1.51$ ;  $M_{\text{Individual}} = 2.03$ ,  $SD_{\text{Individual}} = 1.34$ ;  $\chi^2(1) = 2.95$ ,  $p = .086$ ). I also observed a strong and recurrent effect of age on children's Theory of Mind such that older children showed better Theory of Mind skills ( $0.46 \pm 0.07$ ;  $\chi^2(1) = 37.58$ ,  $p < .001$ ). Theory of Mind scores were also affected by culture ( $\chi^2(2) = 99.10$ ,  $p < .001$ ). That is, German children ( $M_{\text{German}} = 3.43$ ,  $SD_{\text{German}} = 1.22$ ) had higher scores than Hai||om ( $M_{\text{Hai||om}} = 2.03$ ,  $SD_{\text{Hai||om}} = 1.06$ ), whereas Hai||om children scored higher than Ovambo children ( $M_{\text{Ovambo}} = 1.15$ ,  $SD_{\text{Ovambo}} = 0.95$ ).

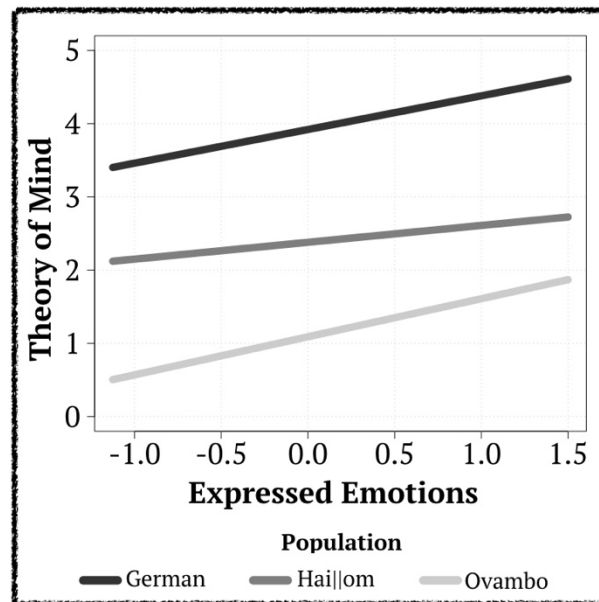


Figure 8. Theory of Mind — Effect of expressed emotions selectively during collaboration (affect index) on Theory of Mind scores (fitted values of Linear Models containing the same predictors and controls as the original model are plotted)

## Discussion

The current results reveal both cross-cultural continuity and variability in children's social motivation for collaboration. Across populations, children expressed more positive emotions when obtaining a reward collaboratively as compared to doing so individually. This effect was strongest among German, attenuated among Ovambo, and weakest among Hai||om children. Children's explicit choices of collaboration varied more strongly between populations: German children preferred peer collaboration over solitary activity. Among Ovambo children, this preference was only evident among younger participants, whereas older participants preferred individual activities. Hai||om children preferred the solitary activity across ages. Both measures of social motivation were positively linked among younger children. Finally, children's positive emotional expressions during collaboration predicted their Theory of Mind skills on an individual level. Together these results indicate that the cross-culturally recurrent tendency to experience positive emotions during collaboration is linked to their children's emerging social-cognitive skills across diverse populations.

The current results lend partial support to universalists' claims regarding the role of social motivation in child ontogeny (Chevallier et al., 2012; Tomasello et al., 2005). According to this view, children experience and express positive emotions during social interactions. These emotions, in turn, can be at the base of a multitude of species-typical levels of (ultra-)sociality (Tomasello, 2014). For example, experiencing positive emotions through collaboration may boost children's prosocial behaviors by motivating them to join and help in adults' activities (Carpendale, Kettner, & Audet, 2015) or to build positive reputations with potential collaborators

(Engelmann & Rapp, 2018). With regard to social-cognitive skills, this emotional aspect of social motivation might facilitate the ontogeny of Theory of Mind which, in turn, enables profitable behavioral coordination between social partners.

In contrast to children's emotional expressions, their choice of collaboration varied more substantially across populations. This heterogeneity increased with age, resonating with previous work documenting that culturally-specific social behaviors emerge over middle childhood (Blake et al., 2015; House et al., 2013; van Leeuwen et al., 2018). Around this age, cultural practices give rise to normative obligations and external rewards resulting from collaborative activities. The robust preference for collaboration among German children may be a cumulative result of typical pedagogical interventions in Western populations, such as praise for collaborative efforts, underpinned by a species-typical intrinsic motivation to collaborate. The preference for individual activity among older Ovambo and Hai||om children may, in contrast, be best explained by the impact of parental cultural models focusing on autonomy, possibly attenuating children's intrinsic motivations to collaborate. The Hai||om emphasize child autonomy from early childhood onwards (Widlok, 1999). Given the choice between collaboration or individual work in order to reach a similar goal may have led Hai||om children to prefer individual action in order to avoid being dependent to the collaborative partner (Boyette & Hewlett, 2017). Among the Ovambo, children's preference for the individual activity emerged only later in ontogeny. While interdependent values are emphasized in Ovambo parenting, older children may be increasingly requested to act autonomously in the context of household chores. This action autonomy marks a central socialization goal among the

Ovambo. A conceivable explanation for these findings is that children preferred individual activities to demonstrate their action autonomy. Interestingly, prior studies on children's social learning preferences document similar ontogenetic shifts toward autonomy among some rural, non-Western contexts. For example, majority influence on children's social learning preferences declines over middle childhood, an effect that may be driven by increasing egocentrism around this age (van Leeuwen et al., 2018). However, it remains unclear to which degree the developmental trends in the current study are specific to the context of collaboration or whether they reflect ontogenetic shifts in social motivation per se.

To assess the construct validity of social motivation, children's expressed emotions were linked to their preferences for collaboration. In younger children, both phenomena were linked positively, supporting claims on the homogeneity of social motivation in early ontogeny (Chevallier et al., 2012). Procedural aspects of this study, such as the assessment of emotional expressions prior to the forced-choice trial, indicate that the experience of positive emotions may have led children to like the collaborative activity, which therefore led them to seek this behavior during forced-choice trials. In line with this finding, Schumacher and Kärtner (2015) found children of slightly younger ages than those tested here to prefer collaborative activities with peers after experiencing positive social interactions with them in a previous activity. Taken together, these results highlight the importance of emotional experience for young children's behavioral preferences in the context of peer collaboration.

Among older participants, however, the two phenomena dissociated from one another or even became linked negatively. Although this finding may appear

surprising at first glance, two explanations may be helpful for classifying this ontogenetic shift in the internal consistence of social motivation. First, cross-cultural differences in children's social behaviors often get consolidated and more pronounced during middle to late childhood (Blake et al., 2015; House et al., 2013). This drift in the data was most evident in children's explicit preferences to choose collaboration or individual activity. Such explicit decisions may be particularly affected by culturally-specific socialization goals, such as the emphasis on action autonomy. Given that, with age, children's explicit preferences differed more across populations than their (intrinsic) emotional expressions, the dissociation between the two phenomena may need to be interpreted as a side effect of the impact of culturally-specific socialization goals in shaping children's explicit and implicit social behaviors. Secondly, it is important to note that previous research has already dissected different components of reward processing, such as liking (e.g., positive emotional expressions) and seeking (e.g., preferential choices) based on their evolutionary origins and the neural circuits in which they are typically processed (Berridge & Robinson, 2003; Berridge et al., 2009). Again, these findings demand for more scientific work combining developmental and cross-cultural approaches together with a focus on interindividual differences to understand the scope and construct validity of social motivation throughout ontogeny.

Individual differences in children's emotional expressions during collaboration predicted their performance in a battery of Theory of Mind tasks. I thus propose that the positive emotions experienced during collaboration function as reward and might consequentially facilitate children's quality and frequency with which they engage in

such interactions. Since engaging in collaborative activities provides a particularly valuable learning context to foster Theory of Mind abilities due to their inherent demands for mental coordination and perspective-taking (Tomasello, 2018; Tomasello et al., 2005), an increase in quality and frequency of social interactions might provide children with increased opportunities for social-cognitive development. A second (reverse) interpretation would be that children's emerging Theory of Mind enables successful coordination with others during collaboration, which, in turn, might make collaborative activities more enjoyable and rewarding. I argue that a combination of both mechanisms is most plausible: Social motivation and social cognition build on one another through the experience children gain in collaborative activities. Future studies need to investigate whether this link is specific to collaborative activities, or whether it applies to social interactions more generally (Carpendale & Lewis, 2004; Chevallier et al., 2012).

In the current study, I found that children's tendency to choose collaboration over individual action varies across three diverse cultural contexts. At the same time, I found that children across populations expressed more positive emotions during collaboration, as compared to individual activity. This cross-culturally recurrent positive emotionality during collaboration predicts social-cognitive development across all three populations. I propose that an enhanced positive emotionality in response to collaboration increases the quality of children's early social interactions, boosting learning opportunities for Theory of Mind across diverse cultural contexts.

## 6

### General Discussion

This dissertation examined the ontogeny of social motivation and social cognition as two facets of sociality from a cross-cultural perspective. Therefore, both constructs were assessed in children from three diverse cultural contexts. Study populations were chosen to reflect a broad range of socialization goals and practices that are typically observed among different modes of subsistence economy (Barry et al., 1959). First, German children were investigated as a proxy for Western, industrialized populations in which children are equipped with high levels of psychological autonomy, whereas action autonomy is given little precedence as a developmental outcome (Keller & Kärtner, 2013). Second, Hai||om hunter-gatherer children were assessed with regards to their cultural emphasis on individual autonomy in both action and psychology, as well as their priority on social learning taking place within peer interactions (Barndard, 2002; Hewlett, 2016; Lew-Levy et al., 2017). Third, Ovambo children were examined given that their emphasizes on interpersonal relatedness and action autonomy are typically stressed among subsistence-based farming populations (Barry et al., 1959; Keller & Kärtner, 2013). To better understand the ontogeny of social motivation and social cognition, I tested children across a broad age range and assessed interindividual differences in their behaviors.

In particular, I was interested in whether children's overimitation, as a strategy for socio-cultural learning, would be similarly actuated by a social motivation across

the three populations (study 1 and study 2) and whether children's imitation would relate to their reengagement of co-players during a collaborative activity (study 1). Next, I investigated the degree to which children's tendency to like and seek peer collaboration varies across cultural contexts (study 3). Finally, I linked interindividual differences in social motivation for peer collaboration to children's Theory of Mind skills (study 3).

In study 1, I showed that children from diverse populations engage in more precise overimitation when being observed by the adult model as compared to being unobserved. Children from all three populations also became more precise and frequent in their overimitation with age. However, regardless of whether or not participants were observed by the model, German children scored higher on overimitation than both Hai||om and Ovambo children. This suggests that across populations, children's overimitation serves a social function and should hence be actuated by social motivation. On an individual level, overimitation did not predict children's reengagement of an adult co-player, which may indicate that their social motivation may be rooted in distinct, context-specific motives that do not necessarily converge on one common, homogenous factor.

In study 2, I documented that German children overimitate more persistently than their Hai||om counterparts, which is in line with the cultural variation in overimitation observed in the first study. Notably, this effect was present even though I utilized a paradigm in which the causally irrelevant actions were clearly marked as such by the (in-group) adult model, the instructions highlighted the instrumental goal of the model's actions, and the containers' functionality was made obvious. Regardless



of the cultural differences in young children's persistence on overimitation, a similar proportion of children in either population indicated that overimitation was principally within their behavioral repertoire.

Combined with the insights gained from study 1, these results indicate that overimitation can indeed be perceived as a functionally universal driver of socio-cultural learning (Nielsen, 2018). Interestingly, the proportion of children showing overimitation at least once throughout the study and of those who did not make use of this behavior at all were similar across cultural contexts. These results thus lend initial support to the idea that variation within populations serves an important function in the interplay of innovation and imitation as drivers of cumulative cultural evolution (Legare & Nielsen, 2015; see also Yu & Kushnir, 2019).

Importantly, this does not mean that culture is not relevant in the ontogeny of overimitation: German children copied irrelevant actions more persistently than their Hai||om counterparts. Even though overimitation is well within the capacity of children from diverse populations, the persistence on overimitation as a strategy of choice appears less robust than previously thought. A further insight gained from study 2 was that, unlike in study 1, overimitation did not vary with age. This finding hints at overimitation and social motivation being more ontogenetically stable than previously thought. Differences concerning age effects between the current and previous results may be best explained by the cognitive task demands in the current study being sufficiently low to allow similar performances in children across a broad age range.

Results from study 3 showed that across populations, children expressed more positive emotions when collaborating with a peer as compared to doing the same activity alone. This effect was strongest among German children and markedly smaller among Ovambo and Hai||om participants. When given the choice between the collaborative and the individual activity, German participants were the only population who preferred to collaborate across the complete age range tested. Younger Ovambo children also preferred collaboration, whereas older Ovambo children preferred the individual activity. Across ages, Hai||om children preferred the individual activity over collaboration.

Positive expressed emotions predicted children's subsequent preferences only among younger children. With age, the two aspects of social motivation became dissociated from one another. While both children's liking (emotional expressions) and seeking (preferential choices) of peer collaboration seem to be ontogenetically rooted in a similar social motivation, both aspects of reward are parsed at older ages where culture shapes children's choices more than their emotional expressions. It thus appears that different indicators of social motivation are shaped by an ontogenetic interplay of children's predispositions and culturally-specific socialization goals and practices.

With regards to the social-cognitive domain, children's skills in the domain of Theory of Mind increased with age across populations. Regardless of age and population, interindividual variation in children's expressed emotions predicted their Theory of Mind abilities. This recurrent link between social motivation and social

cognition supports claims that both phenomena are developmentally intertwined facets of sociality (Chevallier et al., 2012; Tomasello, 2018).

In sum, the current set of studies documents both homogeneity and variability in the early ontogeny of social motivation and social cognition. Across populations, children were motivated to interact with their social partners. Among younger children, different indicators of social motivation were linked at individual levels (e.g., expressed emotions and forced-choice preferences). Differences in sociality across populations recurred across studies and phenomena. Expressed emotions even predicted children's Theory of Mind across populations and ages, suggesting that social motivation and social cognition work in tandem throughout child development.

To elaborate on the importance of culture on shaping social motivation and social cognition, I will now subsume some key findings gained from the current studies separately for each population before trying to integrate these patterns into an overarching framework.

## **The German Context**

In all three studies of this dissertation, German children were outliers with regards to sociality. They showed higher levels of overimitation than their Namibian counterparts (studies 1 and 2), expressed more positive emotions during collaboration and preferred collaboration during forced-choice trials (study 3), and scored highest in Theory of Mind tasks (study 3). With increasing age, German children's social-motivational and social-cognitive dispositions became more pervasive. These studies thus replicate and extend claims on the ubiquity of social motivation and social

cognition in Western children (Tomasello, 2014, 2019). However, it is important to note that the generalization of such claims outside Western populations does not do justice to the immense variability in social motivation and social cognition between and within the populations observed here.

As described above, German childrearing practices implement and focus on culturally-specific socialization goals (Keller, 2007; Keller & Kärtner, 2013). First, German children are equipped with high levels of psychological autonomy. They are free to navigate social interactions with peers and adults according to their own preferences, which may likely increase the reward value of social interactions to them both prospectively and retrospectively. In the urban German context, social interactions are rarely perceived as interpersonal obligations given the emphasis on psychological autonomy and the broad range of play-like activities children are offered in their daily lives (e.g., playing with toys, watching movies, or stories being read to them). Children are also given the opportunity for privacy, such as by being equipped with personal space and time for individual play (Keller, 2007; Kärtner, 2015). Such opportunities may lead German children to de-evaluate the opportunity for individual play when given the opportunity for social interactions.

In combination with the cultural emphasis on child-centered pedagogy among German parenting practices, the high relevance of psychological autonomy is also reflected in parents' monitoring and paraphrasing of their children's desires and beliefs (Kärtner, 2015). Doing so enables children to theorize and converse about their own and other's subjective mental states, resulting in social-cognitive skills that are already refined early in ontogeny. In this context, it is commonly assumed and

expected that behavior is caused by mental states. This idea is often implemented into child pedagogy through conversations about mental states and mind-minded language (Meins et al., 2002; Kärtner, 2015). In line with this assumption, child-directed conversations about mental states have been found to predict mindreading abilities, such as false belief reasoning, among Western children (Laranjo, Bernier, Meins, & Carlson, 2014; Meins et al., 2002).

At the same time, children in Germany are rarely tasked with household chores until adolescence. Instead, their learning typically takes place under the supervision of adult caregivers. Socially adequate and prosocial behaviors are often supported through praise and other forms of positive feedback, which may function as external incentives that reward affiliative behaviors (Köster, Cavalcante, Vera Cruz de Carvalho, Dôgo Resende, & Kärtner, 2016). Situations in which children can explore their environment in a playful manner within social interactions are perceived as optimal learning opportunities. Instead of strong social obligations for interactions, children can choose freely between social partners (Keller & Kärtner, 2013). This conceptualization of social interactions as a voluntary, joyful learning opportunity may foster social motivation, leading to the exceptionally high levels of overimitation and collaboration among German children when compared to other populations.

## **The Hai||om Context**

Similar to their German counterparts, Hai||om children engaged in overimitation, expressed more happiness during collaborative activities, and predicted others' mental states. However, they showed less overimitation than their German

counterparts (studies 1 and 2). They also expressed fewer positive emotions during peer collaboration than both Ovambo and German children. Moreover, Hai||om children consistently preferred individual work over collaboration during forced choice trials (study 3) and performed intermediate between Germans and Ovambo on Theory of Mind tasks (study 3).

What might be the cultural drivers of this pattern of results? Among the Hai||om, children are equipped with high levels of both psychological and action autonomy from early on (Berl & Hewlett, 2015; Konner, 2005; Terashima & Hewlett, 2016; Widlok, 1999). At the same time, opportunities for social learning are typically not child-centered (Boyette & Hewlett, 2017; Lancy, 2008). Instead, learning instances are diverse, short, spontaneous, and integrated into daily social life and subsistence activities (Boyette & Hewlett, 2017).

If the low levels of action autonomy in combination with the emphasis given to child-centered pedagogy biases Western children toward socially motivated interactions and collaboration, the emphasis on action autonomy and observational learning among the Hai||om may have caused the behavioral patterns observed for this population. Choosing to complete a task individually and without the support of others may be preferred as doing so displays autonomy and competence. Even though action autonomy does not imply that social interactions are actively avoided, this emphasis may facilitate a more nuanced social motivation in Hai||om children as compared to Western populations. Such differences may be particularly pronounced whenever individuals can solve a task by themselves (such as in the simple collaborative task manipulated in study 3). Whenever approaching novel or difficult

tasks in which social support may be required, one might expect Hai||om children to prefer social over individual means. Additionally, Hai||om children are accompanied by their peers during most of their daily activities, which could have also driven them to prefer individual activities in the context of study 3. Given the cultural emphasizes on egalitarianism and sharing on demand, children may have used the opportunity to engage in the activity alone by themselves to avoid behavioral dependence on their interactants.

The low levels of child-centered pedagogy may have also impacted children's socially motivated behaviors. The rates of overimitation were markedly lower among the Hai||om than among German children. Instances of direct, child-centered pedagogy, such as the context in which overimitation is typically assessed, are rare among hunter-gatherer populations such as the Hai||om (Boyette & Hewlett, 2017; Hewlett, 2016; Lew-Levy et al., 2017). Typically, hunter-gatherer children learn novel behaviors through the observation of others, are free to explore objects, and modify their actions gradually over time. As a consequence, these children may be more flexible in choosing between overimitation, emulation, and innovation when facing the opportunity to learn from others.

Importantly, this does not imply that Hai||om children only emulated or innovated. They showed overimitation selectively in the presence of the model (study 1) and irrespective of instructions depicting an instrumental, rather than a social goal (study 2). These results thus indicate that while the persistence on overimitation is lower among Hai||om children (as compared to German children), the majority of children use overimitation and do so to affiliate with others.

Socialization goals regarding psychological autonomy may have been a key determinant of Hai||om children's performance in Theory of Mind tasks. Even though children's social motivation was linked to their performance across Theory of Mind tasks, the comparatively low levels of social motivation among Hai||om children did not result in lowest scores on the social-cognitive domain. Instead, Hai||om children's scores laid between those of German and Ovambo children. It may thus be that an interplay between social motivation, child-directed pedagogy, and psychological autonomy together shape children's Theory of Mind throughout ontogeny. That is, a focus on action autonomy, together with the low levels of explicit mental state talk between adults and children may explain why Hai||om children scored lower than German children on the Theory of Mind tasks. The psychological autonomy with which Hai||om children are equipped with may compensate this partially by emphasizing and acknowledging different perspectives on the world. Again, a complex interplay of contextual factors causes cross-cultural and interindividual variation in the ontogeny of social motivation and social cognition.

## **The Ovambo Context**

Ovambo children showed overimitation at comparable levels to their Hai||om counterparts (study 1). However, they scored higher than Hai||om participants on measures of social motivation during peer collaboration (study 3), even though older children became more biased toward individual activities. At the same time, Ovambo children scored lower than same-aged Hai||om and German children on Theory of Mind tasks. Again, these patterns may be best explained by considering cultural



emphasizes on psychological autonomy, action autonomy, and the role of child-centered pedagogy in this context. Among the Ovambo, parents typically stress action autonomy as an important socialization goal. That is, one central task in child development is that children learn to pursue and fulfill tasks independently and without external advice or help. This perspective may have led older children to prefer individual means over collaboration during study 3 to signal their action autonomy.

At the same time, Ovambo children grow into a system where age-related hierarchies, respect, and social responsibilities are given high importance (Zimba, 2002; Zimba & Otaala, 1993). Children are thus reared toward high levels of psychological relatedness. In this context, children's consideration of subjective mental states as a driving force of human behavior may be of lower relevance than among Hai||om and German children: Ovambo children's behaviors are embedded in a dense system of social relations, hierarchies, and obligations. This may lead to a lower emphasis on individual desires and beliefs as determinants of behavior as compared to children that are equipped with higher levels of psychological autonomy (Kärtner, 2015). Furthermore, participation and observation are key sources for social learning among the Ovambo, and conversations between adults and children about mental states are rare as compared to Western, industrialized contexts (Zimba, 2002).

Another factor that may shape Ovambo children's social-cognitive development is that parents often use authoritarian parenting practices and emphasize obedience in raising their children (Brown, 2011; Zimba, 2002). Such parenting styles have been argued to possibly delay the capacity to engage in explicit, verbal mindreading abilities in other societies (Kuntoro et al., 2013; Vinden, 2001). It

is, however, plausible that low levels of psychological autonomy often go hand in hand with authoritarian parenting practices (such as in the case of the Ovambo). Systematic assessments of both factors in parallel warrant a more precise understanding of the socialization goals and practices shaping the ontogeny of Theory of Mind.

As an additional constraint, the task demands of the Theory of Mind battery implemented in study 3 may have also restricted Ovambo children's performance in this domain. Here, we used an adaption of a frequently used set of story vignettes (Wellman & Liu, 2004) in which children reply to an adult's question verbally and in a playful manner. Such answer probes resemble adult-child interactions in Western populations much more closely than those among hierarchically structured societies like the Ovambo (and the Hai||om, too). Here, children predominantly learn through participation and observation, rather than direct, child-centered pedagogy (Zimba, 2002). Given children's limited exposure to such scenarios, procedural aspects utilized here may have evoked confounding effects, such as nervousness and shyness in some participants. As a consequence, children's social-cognitive competences may have been masked systematically (see also Ojalehto & Medin, 2015; for a similar argument). Novel approaches assessing children's social-cognitive skills in more naturalistic interactions are a promising avenue to overcome this limitation. For example, children's use and anticipation of deception in peer communication may be an ecologically valid means to assess false-belief reasoning given the conceptual interdependence between the two phenomena (Wimmer & Perner, 1983; Sher, Koenig, & Rustichini, 2014; Talwar, Gordon, & Lee, 2007).

## **An Integrative Model of Social Motivation and Cognition**

The results of the three studies in this dissertation reveal both cross-cultural variability and homogeneity in the ontogeny of social motivation and social cognition. In Figure 9, the main conclusions drawn from the current dissertation are combined into an overarching framework. This integrative model of social motivation and cognition (henceforth: SMC) combines elements of the ecocultural model from Keller and Kärtner (2013) with conceptualizations of social motivation and social cognition borrowed from the cognitive sciences and developmental psychology (Chevallier et al., 2012; Hobson, 2002; Levinson, 1995; Tomasello et al., 2005). Culturally-specific socialization goals and practices are illustrated in the upper background of the figure. Accordingly, cultural contexts differ in how children's experience and behavior are shaped toward autonomous or relational socialization goals. These goals are typically reflected in culturally-specific socialization practices. For example, these include whether and how caregivers actively attempt to modify child behavior via child-centered pedagogy or child-directed speech (e.g., mind-mindedness). Given that child-centered pedagogy provides children with useful opportunities for social learning, such practices may increase the motivational value of social interactions directly through associative learning processes. At the same time, such practices provide children with opportunities to reflect upon their own and others' minds, facilitating the development of social-cognitive abilities.

The interplay of culturally-specific socialization goals (e.g., psychological autonomy and action autonomy) and practices (e.g., child-centered pedagogy) shapes the co-development of social motivation and social cognition on a "Conceptual Level"

(visualized in the upper part of Figure 9). These two facets of sociality are developmentally intertwined and manifested in children's behaviors in social interactions. As such, it is the interplay between culturally-specific socialization goals and practices as well as a co-development of social motivation and cognition that constitutes the ontogeny of sociality.

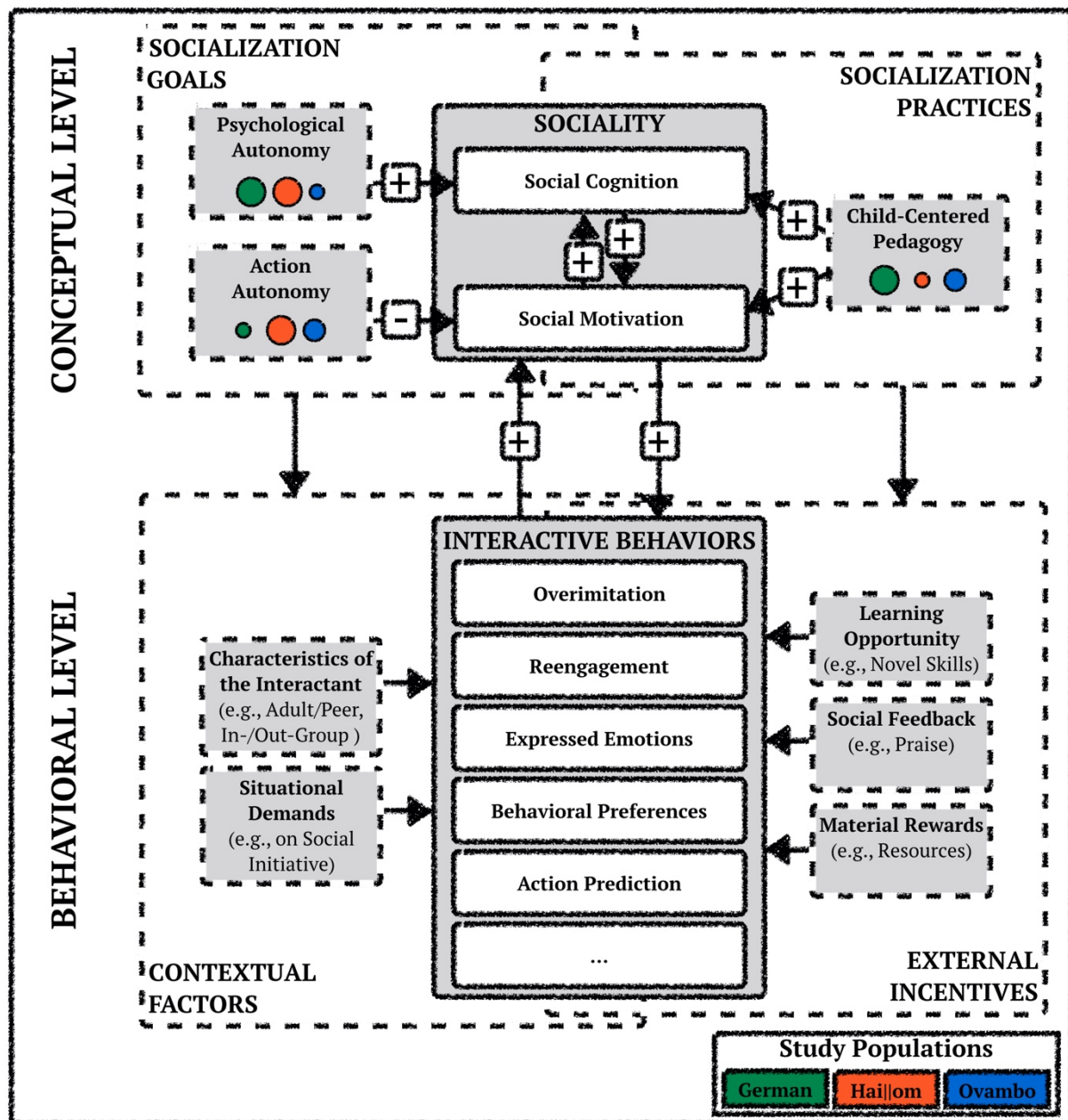


Figure 9. An integrative model of social motivation and cognition (SMC); larger bubble sizes indicate population-specific emphasizes on the respective socialization goals and practices; “+” and “-” indicate whether pathways between concepts are typically positive/promotive or negative/inhibitive; dotted frames reflect variables that are external to the child; solid frames indicate intrinsic processes or behaviors

The interplay of social motivation and cognition determines the behavioral repertoire children make use of within social interactions (“Behavioral Level”; lower part of Figure 9). A variety of behaviors enable children to engage in and benefit from social interactions. These include some of the phenomena assessed thoroughly in this dissertation (e.g., overimitation, reengagement, predicting others’ actions using Theory of Mind), but also other phenomena that support them in navigating social interactions (e.g., conformity; see below).

To account for the importance of external demands on shaping children’s social behaviors within a given situation, “Contextual Factors” and “External Incentives” are presented in the lower background of Figure 9. Depending on the situation, external incentives may increase the reward value assigned to either social or individual activities. For example, social activities may be externally rewarding whenever they can lead to material benefits that could not be achieved otherwise. At the same time, individual activities may be incentivized whenever individual action is associated with the opportunity to learn more efficiently. Characteristics of the interactant (e.g., affiliative behaviors are more likely when interacting with friends, as opposed to strangers) and situational demands (e.g., the degree to which social initiative is needed to affiliate with others) are important contextual factors that affect young children’s social behaviors within social interactions.

While the SMC primarily builds on the cross-cultural evidence gained from the current dissertation, it may also be helpful for understanding and predicting interindividual variability in young children’s sociality. In the following paragraphs, I aim at integrating this perspective into the SMC.

First, one conclusion that can be drawn from this dissertation is that interindividual variation in social motivation and cognition is substantial and meaningful. In study 2, for example, the proportions of non-overimitators and overimitators were almost similar among Hai||om and German participants. Such variation patterns on population levels may be highly functional by fostering the interplay of innovation and imitation in the accumulation of cultural information (Yu & Kushnir, 2019). While a stable proportion of children copies and transmits cultural information with high fidelity, others chose different strategies, such as emulation or innovation. More research is needed to assess the degree to which interindividual variation in behavior reflects unsystematic noise or, in contrast, whether it entails informative value about the composition of behaviors at a population level that may itself be derived from selective pressures on a macro-level (see also Mesoudi, 2011).

As a second conclusion with regard to individual differences in social motivation and cognition, this dissertation shows that behavioral manifestations of either facet can, but not necessarily must, be linked on an individual level. Study 1 did not find support for the hypothesis that frequent overimitators would also show more reengaging attempts in the context of collaboration. Even though both behaviors were most pronounced among German children as compared to both Hai||om and Ovambo, they appeared to be conceptually distinct. A more mixed finding was observed in the domain of collaboration. Here, interindividual links between children's positive expressed emotions during collaboration and their preferences during forced-choice trials were only evident among younger children. With increasing age, the link between both proxies for social motivation in the context of collaboration weakened.

According to the SMC, the absence of such links may be caused by contextual factors varying between paradigms. While the active reengagement of a recalcitrant co-player requires an individual to show social initiative, overimitation does not. Interindividual differences in shyness or extraversion may have thus covered potential links between the two phenomena. In study 3, children's preferred choices during collaboration may have dissociated from their expressed emotions among older children because of their (external) reward value. While emotional expressions may predominantly reflect an intrinsic motivation to engage in an activity, the more explicit choice of either collaboration or individual activity may be increasingly shaped by societal emphasizes on action autonomy.

Importantly, contextual factors are also likely to be shaped by culturally-specific socialization goals and practices. For example, reserved, yet socially attentive temperament dispositions are typically emphasized among collectivistic societies (Chen & French, 2008; Lane et al., 2013). Western populations, in contrast, value social initiative and extraversion as important socialization goals in child development. Cultural contexts emphasizing social initiative may thus lead to different social behaviors than those emphasizing more reserved behaviors, irrespective of children's social motivation per se.

The same applies to the characteristics of the potential interaction partner for eliciting affiliative behaviors. Among Western populations, young children predominantly rely on adult pedagogy as a source of information. It is thus no wonder that, among such contexts, children prefer testimony from adults over that of peers (Jaswal & Neely, 2006). In contrast, social learning among other, non-Western



populations often takes place within peer groups (Boyette, 2016; Boyette & Hewlett, 2017; Lew-Levy et al., 2017). Here, one may even expect children to prefer information provided by their peers over that of adults under certain circumstances, especially if previous encounters with their peers were successful (see also Schuhmacher & Kärtner, 2015).

As such, the SMC suggests that contextual factors can in part account for the observed heterogeneity in the behavioral proxies for social motivation and social cognition in various ways. Given the aforementioned interplay between factors at the conceptual level (e.g., socialization goals and practices) and those at the behavioral level (e.g., contextual factors, external incentives), future research will need to consider both levels in parallel in order to understand and predict ontogenetic, cross-cultural, and interindividual variation in social motivation and social cognition.

## **Many Facets of Social Motivation**

Irrespective of the exact impact ascribed to contextual factors in shaping children's sociality, one conclusion derived from the SMC is that sociality, and social motivation in particular, should not be conceived as stable, trait-like set of dispositions. Children's social motivation for engaging in social interactions depends on multiple determinants working in parallel.

As a first factor, individual predispositions in the responsiveness to social stimuli may be an early determinant of social motivation at later ages. For example, social temperament has previously been indicated as an important and stable factor

in shaping young children's social interactions (Asendorpf & Meier, 1993; see also Lane et al., 2013).

Second, social motivation co-develops with children's social-cognitive skills in that both facets are required for successful participation and coordination in social interactions (Carpendale & Lewis, 2004; Roby & Scott, 2016; Tomasello, 2018). Next, development itself can be an important factor in shaping social motivation. For example, typical ontogenetic trajectories in children's social learning preferences indicate that children's reliance on social information and social interactions follows recurrent trajectories (Boyette & Hewlett, 2017; Lew-Levy et al., 2017; van Leeuwen et al., 2018). Depending on the type of social learning that is of interest, these trajectories may show more or less variation across cultural contexts (van Leeuwen et al., 2018).

Finally, contextual factors, such as task difficulty, interdependency (Warneken et al., 2012), or whether joint efforts can lead to higher payoffs (Bullinger et al., 2011), may also trigger the expression of social motivation in a given context. For example, individuals may be differently affected based on whether a social interaction implies behavioral interdependency between actors (such as in the context of collaboration), or whether social ties are rather loose (such as when deciding whether to be in spatial proximity with others). Those who are equipped with high levels of autonomy may show fewer attempts to engage in collaborative activities in order to avoid behavioral interdependency. At the same time, children may show socially motivated behaviors whenever the circumstances do not imply interdependence, such as in the context of imitation. Additionally, other forms of interdependence (such as competition or

cooperation within competition) may trigger different motivations than those investigated in this dissertation (Deutsch, 1949).

### ***Other Phenomena Linked to Sociality***

One main goal of this dissertation was to gain insights into the ontogeny of sociality with a particular focus on the development of social motivation. I focused on two phenomena as proxies for children's social motivation, as well as one indicator for social cognition. Of course, this subset is far from comprehensive to reflect the scope of human sociality (Tomasello, 2014, 2019). To fully understand the ontogeny of social motivation and cognition, several other aspects of human sociality need to be addressed in future research.

For example, social motivation has previously been discussed as an ontogenetic driver of children's prosocial behaviors (Carpendale et al., 2015; Dahl & Brownell, 2019; Paulus, 2014, 2018). Accordingly, children start to help others because of their interest in joining and attending social interactions during their first two years of life. This social interest is only transformed into a more prosocial motivation for the welfare of others at later ages. While children's tendency to provide help for others is robustly found across diverse cultural contexts (Callaghan et al., 2011), their motivation for doing so is shaped by socialization goals and practices (Giner Torrés & Kärtner, 2017; Köster et al., 2016). Moreover, prosocial behaviors have been linked to other aspects of sociality, such as Theory of Mind (Imuta, Henry, Slaughter, Selcuk, & Ruffman, 2016) and imitation (Yu & Kushnir, 2019; but see Warneken & Tomasello, 2007). Since I did not assess children's prosocial behaviors in this dissertation, I can

only refer to theoretical arguments on the interplay of social and (pro)social motivations in shaping prosociality (Carpendale et al., 2015; Paulus, 2014, 2018).

While the link between imitation and social motivation has received most attention in this dissertation, other social learning strategies may also be linked to children's social motivation (Deutsch & Gerard, 1955; Hanayama & Mori, 2011; Haun & Tomasello, 2011; van Leeuwen et al., 2018). Western children show conformity by copying the behavior of a majority even if this implies that they need to abandon their initial tendencies (Haun et al., 2014; Haun & Tomasello, 2011). The fact that children adapt their behaviors to meet those of the majority is particularly pronounced whenever the response is made in public suggests conceptual links between conformity and social motivation (Deutsch & Gerard, 1955; Nielsen & Haun, 2016). Accordingly, conforming to others may serve an affiliative function similar to that discussed for overimitation (Nielsen & Haun, 2016; Whiten, 2019). Again, cross-cultural investigations assessing whether conformity can be conceived as a behavioral manifestation of social motivation are needed to gain a better understanding of the origins of human sociality (Clegg, Wen, & Legare, 2017; see also van Leeuwen et al., 2018; Wen & Legare, 2017). Such attempts may also reveal how social learning itself is learned and shaped through social interactions (Heyes, 2012b). In one recent study, van Leeuwen and colleagues documented an age-related decrease in children's reliance on social information, although this effect varied substantially across populations (van Leeuwen et al., 2018). In the same study, the researchers also documented an ontogenetic trajectory in which children's preferences for the strategies displayed by the majority of models first decreased around middle

childhood before becoming more influential at later ages. Accordingly, children's social learning strategies need to be conceptualized as the result of a complex interplay of cultural context, age, and characteristics of the specific learning context.

### ***The Role of Social Orienting and Social Maintaining***

As mentioned in the introduction, the *Social Motivation Theory of Autism* defines social motivation in a much broader sense than what I operationalized in this dissertation. Here, I almost exclusively focused on *Social Reward*, or the tendency to seek and like social interactions. Chevallier and colleagues (2012) also theorize *Social Orienting* and *Social Maintaining* as central components of social motivation. How do these components relate to the main conclusions of this dissertation?

*Social Orienting*—the attentive bias to attend and orient to social stimuli—may support children's seeking and liking of social interactions by ensuring that individuals can benefit from opportunities for social interactions. This may be especially relevant in non-Western populations in which direct, child-centered pedagogy is rare. Individual dispositions to attend social interactions (Atkinson, Simpson, & Cole, 2018), paired with an intrinsic motivation to like these interactions, may be a powerful combination enabling children to orient to and learn from social interactions. Notably, as a consequence of the reward value children attach to social interactions, they may “become ever more oriented to the social world” (Godman et al., 2014; p. 575).

Cross-cultural studies indicate that parenting practices among traditional, non-Western populations foster children's social orienting from early on. For example, Hewlett and Roulette (2016) describe the socialization practice of

“distribution parenting” among the Aka hunter-gatherers of central Africa. Accordingly, parents place their infants facing away from themselves such that the infants can observe others’ daily interactions and activities. Such manipulations and practices may equip children with important opportunities for social learning by utilizing their social attention. At the same time, cultural emphases on children’s autonomy are granted since infants can freely choose to attend to the social input they prefer.

*Social Maintaining*—the tendency to establish long-lasting social bonds with significant others—is also considered a cross-culturally recurrent manifestation of social motivation (Chevallier et al., 2012; Over, 2016). Accordingly, children invest into long-lasting social relationships and form friendships to fulfill their need to belong. In the light of children’s tendency to seek and like social interaction, *Social Maintaining* may be highly adaptive by maximizing the quality and quantity of social interactions through forming temporarily stable opportunities for social interactions. Again, doing so may be conceived as a consequence of the reward value children ascribe to social interactions.

These dynamics may be of particular relevance outside Western, industrialized contexts. In traditional, small-scale populations, the need to establish and maintain positive relationships with other members of the community can be of central importance given that the number of potential interaction partners is limited. Especially in times of scarce resources, it may have been particularly beneficial to establish long-lasting relationships even with individuals outside own family bands or communities. !Xun/!Kung hunter-gatherers, for example, practice a system in

which gifts are transferred within individual social networks (Wiessner, 1977, 1982). The social bonds between individuals that are established within this *hxaro* system offer security in times of scarcity. Individuals can rely on their *hxaro* partners to receive material gifts whenever they are in need of help (Wiessner, 1977). As such, *Social Maintaining* may be deeply rooted in human psychology. More research investigating the potential links between *Social Reward*, *Social Maintaining*, and *Social Orienting* is needed to fully understand the development of young children's social motivation.

## **Limitations and Outlook**

The current set of studies suggests that sociality is a complex, multi-faceted phenomenon that is ontogenetically founded within children's social interactions. The motivational and cognitive prerequisites to engage in and benefit from social interactions are consolidated throughout early childhood and lay the ground for our species-typical reliance on social learning.

One explanation for the heterogeneity of social motivation in this dissertation is that this pattern is mainly caused by systematic limitations of the studies themselves. First, limited sample sizes among the small-scale populations, combined with substantial behavioral variability due to broad age ranges and cultural heterogeneity, may have lowered the statistical power of the studies presented here. To reliably observe interindividual patterns in social motivation across populations, future studies will need to assess children's social motivation in larger samples.

Another limitation lies in the cross-sectional research designs of the studies in this dissertation. First, such approaches do not allow for definite conclusions about the causality of developmental pathways, such as whether social motivation causes social-cognitive development, or vice versa. A second drawback of cross-sectional approaches is that they can identify intrapersonal links between phenomena only at specific ages. However, some socially motivated behaviors may be most pronounced in early childhood, whereas others may only become relevant at later ages. Assessing these phenomena only concurrently may thus fail to find conceptual homogeneity in social motivation. Children's motivation for showing overimitation, for example, may undergo a complex developmental trajectory. Around two years of age, they may show the behavior primarily because they do not yet fully understand the causal irrelevancy of some actions, thus preferring a "copy all, refine later"-strategy in order to avoid missing opportunities for social learning (Lyons et al., 2007; McGuigan et al., 2011). Following this, the social motivation to do so may increase during middle childhood when children learn about the affiliative function of overimitation (Clay et al., 2018; Gellén & Buttelmann, 2019). Later, this social motivation may be transformed into a more normative stance based on which children imitate (Gellén & Buttelmann, 2019; Keupp et al., 2013). Longitudinal approaches are needed to fully understand how behavioral variability and motivations are shaped throughout ontogeny and to assess the degree to which developmental pathways vary across and within populations.

A third limitation concerning this dissertation is the limited age range tested across studies. Future research will need to assess children of markedly younger ages than those investigated here (e.g., children's first three years of life). Enculturation



takes place up from, or even before, birth and the social input children receive in their first years of life is central for understanding concurrent and later development. For instance, local patterns in the contingency of caregivers to infants' behaviors has significant effects on social development already at three months of age (Kärtner et al., 2008; Kärtner, Keller, & Yovsi, 2010). Therefore, it is necessary to study children as young as of infant age in order to understand the developmental and cultural origins of social motivation and social cognition.

Originally, I aimed at assessing cross-cultural differences in social motivation among infants as well. However, I was not able to obtain valid data from children of such ages due to several issues. First, sample sizes in the rural populations were often too small for drawing statistically reliable conclusions. Second, children at such ages were often afraid to act in the presence of foreign adults and did not want to participate in the studies. Novel and innovative approaches are thus needed to assess interindividual differences in the ontogeny of social motivation and social cognition during children's first years of life cross-culturally. These may include the use of systematical observations of children's daily experiences or the acquisition of data via modern technology, such as through automatized movement tracking via GPS or Beacon technology (Migliano et al., 2017), (mobile) eye tracking devices (Hepach & Westermann, 2016; Hepach & Herrmann, 2019), depth sensor imaging technology to assess body posture (Hepach et al., 2015, 2017), and audio recordings (Bergelson et al., 2019).

The (quasi-)experimental approaches I followed in conducting the current studies were chosen because I aimed at relating children's behaviors on an individual

level. While experimental rigor and internal validity are basic demands for drawing such conclusions, such approaches may cause problems concerning the external validity of research findings. Ethnographic and qualitative approaches are needed to estimate how the current results can be used to understand population-specific trajectories in the ontogeny of social motivation and social cognition. Implementing different perspectives into a research agenda, such as by combining quantitative and qualitative approaches, will be helpful for improving the ecological validity of scientific findings while also ensuring the precision, objectivity, and generalizability gained through (quasi-)experimental procedures (Norenzayan & Heine, 2005). One promising approach hereby is that of summarizing and analyzing qualitative data (e.g., ethnographical information) by utilizing quantitative protocols and methods (see Boyette & Hewlett, 2017; Lew-Levy et al., 2017, 2018; for such meta-ethnographic approaches).

Using a combination of these approaches, one may be able to test hypotheses that can be derived from the SMC. As a first prediction, one would predict socially motivated behaviors to be linked not only concurrently, but also longitudinally. This would include those phenomena assessed in this dissertation (e.g., overimitation, positive emotional experience, preferences), but also other potential indicators of social motivation (e.g., persistence and effort invested, physiological arousal, conformity). Again, longitudinal designs are needed to identify whether early emerging behaviors (e.g., emotional expressions, overimitation) predict and precede those that are refined later in ontogeny depending on cultural input (e.g., effort, explicit choices). While such a hypothesis would imply systematic trajectories in

social-motivational development, it would not necessarily predict cross-cultural homogeneity in social motivation: Depending on cultural emphasizes on the role of action autonomy, social motivation should vary systematically across populations. It would be interesting to see whether predictions drawn from the SMC will hold true when tested among cultural contexts focusing on low levels of action autonomy (such as in urban Germany) while emphasizing observational learning, rather than direct, child-centered pedagogy (such as among the Hai||om and Ovambo).

With regard to children's social-cognitive development, the SMC would also predict that children from populations emphasizing psychological autonomy would develop a fully-fledged Theory of Mind at younger ages than children growing up in populations in which hierarchical relatedness and authoritarian parenting practices are stressed (Kärtner, 2015; Kuntoro, Peterson, & Slaughter, 2017). As a potential confound, social-cultural beliefs concerning "opacity of mind" have also been argued to constitute cultural variation in the ontogeny of Theory of Mind (Dixson et al., 2017; Mayer & Träuble, 2013). Unravelling the interplay of such doctrines with the role of psychological autonomy offers a promising agenda to understand the ontogeny of social cognition within social interactions.

Revealing this interplay will also be relevant for our understanding of other phenomena linked to uniquely human sociality. For example, the importance of Theory of Mind (e.g., concerning others' intentions) on moral judgements is known to vary systematically across populations (Barrett et al., 2016) as a function of socio-cultural beliefs regarding opacity of mind (McNamara et al., 2019). To which degree socialization goals and practices regarding psychological autonomy contribute to

such patterns will be an interesting question to address while utilizing the SMC as a theoretical framework.

A third prediction derived from the SMC concerns intra-cultural variability in action autonomy, psychological autonomy, and dyadic pedagogy. Following the SMC, one would expect interindividual variability in caregivers' use of direct pedagogy to affect the reward value of adult-child interactions which should lead to downstream effects on social motivation and cognition. Interindividual variation in socialization goals and practices may be assessed using questionnaires, such as the Socialization Goals Questionnaire (SGQ; Kärtner, Keller, & Chaudhary, 2010; see also Fonseca, Cavalcante, Kärtner, & Köster, 2018), structured interviews, or behavioral observations of children's daily lives. Such data may then be linked to children's social motivation and cognition in order to assess whether and how the SMC can be applied to explain variation in sociality within populations.

Finally, based on the SMC one would expect that the developmental mechanisms observed among humans would also be observable among non-human primates, such as among chimpanzees and bonobos. Although there is little evidence on systematic interindividual differences in sociality among chimpanzees (Herrmann et al., 2007), other studies have revealed distinctive, population-specific patterns in sociality across chimpanzee groups (Cronin, van Leeuwen, Vreeman, & Haun, 2014; van Leeuwen, Cronin, & Haun, 2018). The SMC proposes social motivation and cognition as recurrent drivers of social development. Comparisons between and within species may reveal important insights into the phylogenetic significance and generalizability of this framework among other taxa (Amici & Widdig, 2019). To assess

the importance of social interactions on shaping social cognition among chimpanzees and other species, a combination of developmental approaches and comparative perspectives is highly needed (Bard & Leavens, 2014; Gerson, Simpson, & Paukner, 2016). This demands for systematic, collaborative efforts from scientists from different laboratories and countries that have the potential to address scientific questions that could not be answered without such an infrastructure (e.g., Many Primates et al., 2019).

## **Conclusion**

In sum, the studies conducted within this dissertation indicate both cross-cultural homogeneity and diversity in young children's sociality. Even though the cultural contexts I investigated vary substantially in their socialization goals and practices, the basic social-motivational and social-cognitive phenomena underlying sociality were pervasive across all populations: Children learn to imitate others and use imitation to strengthen social ties. They experience positive emotions during collaboration and understand and predict others' mental states by utilizing their Theory of Mind. The ontogenetic mechanisms shaping this sociality appear universal: Sociality emerges early in ontogeny and is refined through social interactions. As a consequence, children's social motivation and social cognition vary substantially across populations. At the same time, cultural differences are founded within social interactions and are thus shaped by sociality. The interplay between culture and sociality constitutes child development and lays the foundations for the immense

variability between individuals and populations that characterizes and enriches our species.

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## 8

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## Appendix

### Appendix A — Additional Information on Study 1

#### *Task on Preference for Collaboration — Design*

After the first overimitation task, participants engaged in an assessment of their explicit preference for collaboration (Task 2). Children retrieved balls one-by-one from a marble run containing 16 balls painted with different colors (three yellow, three green, ten two-tone/ambiguous). Children sorted these balls according to color (yellow vs. green) into one of two wooden boxes with matching colors. Crucially, one of the boxes could be opened collaboratively, the other individually (color and location of boxes were counterbalanced across participants). While the distribution of balls was unambiguous for one-colored balls, two-tone balls could be sorted freely. Instructions were given from videos.

#### *Task on Preference for Collaboration — Materials*

Two wooden boxes (28cm x 28cm x 28cm) were used as containers for sorting in balls. The containers looked similar with exception of their color (green vs. yellow). Both containers could be opened by pulling a rope attached to the top of the box, moving a polycarbonate platform so that a round hole in the top (diameter = 10cm) gave access to the inner of the container. On one of the boxes, there was a single rope (length = 50cm) attached that could be pulled individually in order to open the box

(Individual Box). The other container was slightly different in that two ropes (each length = 60cm) had to be pulled by both coplayers in order to open it (Collaboration Box). To underline these differences in the opening mechanisms, wooden Pictograms of either one (Individual Box) or two characters (Collaboration Box) were attached to the front side of the containers.

A marble run (50cm x 12cm x 11cm) was used for enabling children to obtain the balls one after another. By pulling a rope (length = 5cm) attached on top of the marble run, one marble at a time could be obtained. Since the marble run was secretly rigged by the experimenter, it was guaranteed that participants had access to only one ball at a time while receiving the balls independently of the experimenter. The marble run was baited with 16 wooden balls (diameter = 3cm) which were dropped in a fixed sequence: The first four balls were single-colored (green; yellow; green; yellow). Afterwards, three ambiguously-colored balls were loaded in the marble run, followed by a single-colored ball (green), three ambiguous balls, a single-colored ball (yellow), and four ambiguous balls. In sum, the marble run was baited with six unambiguous and ten ambiguous balls.

### ***Task on Preference for Collaboration – Procedure***

After children got the reward from the first overimitation task, they were led to a corner of the room in which there was a marble run in between two wooden boxes (Individual Box and Collaboration Box). The experimenter attracted the attention of the child to a laptop screen on the floor. On screen, children saw a scenario in which two actors played a game using two similar boxes and a similar marble run. One of the actors retrieved a ball from the marble run. He then checked whether the color of the



ball (i.e., green) fitted to that of the Individual Box (i.e., yellow). He then moved to the Collaboration Box with the matching color (i.e., green) and nodded. The actor then put the ball on top of the Collaboration Box and finally opened the box together with the second adult by pulling a rope attached to the box simultaneously. The ball fell down into the box. He then retrieved a second ball from the marble run (e.g., yellow), again compared the color of the ball with that of one box (Collaboration Box; e.g., green) and finally matched the colors with the other box (Individual Box; e.g., yellow). Here, the actor put the ball on the box and pulled the rope alone by himself. The ball fell down into the box. The next ball (e.g., green) was retrieved from the marble run and put into the Collaboration Box collaboratively before finally retrieving and sorting in a fourth (e.g., yellow) ball into the Individual Box individually. Afterwards, the laptop was put aside by the experimenter and participants were asked to play the game themselves.

The first four balls were presented one after another in a fixed order (green — yellow — green — yellow) and children learned the rule of sorting the balls according to their color either collaboratively with the experimenter or alone. After these four trials, children were suddenly confronted with an ambiguous ball (half green, half yellow). Children were signaled that here they could decide on their own where to sort them. Children were subsequently confronted with ten ambiguous balls and two more unambiguous balls in order to remind them of the general rules of the game.

### ***Task on Preference for Collaboration — Discussion***

During both testing and coding the data, I found that most children in either population followed a specific strategy in their box choices: They tended to alternate

between the Individual Box and the Collaboration Box. This behavior made it difficult to interpret their choices as preference scores. Thus, I did not conduct further statistical analyses (see discussion).

In constructing the task, our main aim was to build on former findings on this construct (Rekers et al., 2011; Schuhmacher & Kärtner, 2015) by specifically focusing on inter-individual differences in collaborative preferences. Children appeared to interpret the game's video instructions (in which two adult models distributed the balls in an A-B-A-B logic) in a normative manner and played in alternating fashion even when being faced with ambiguous balls. Another possibility is that children had difficulties in understanding the instruction from videos given to them on a laptop screen. However, such methods have been used in other cross-cultural studies before (van Leeuwen et al., 2018). Future studies examining children's preference for collaboration are needed to fully understand social motivation with regards to its individual, situational, and cultural variation. One important means would be to avoid using alternating behaviors during instruction videos (e.g., by using an A-B-B-A logic) or to counterbalance these behaviors on video. Another possibility would be to allow participants to engage in only one forced-choice trial (such as in Rekers et al., 2011; Schuhmacher & Kärtner, 2015). Alternative paradigms to investigate children's preference for collaboration may also include their positive affect displays (Perlmutter et al., 1989) or the time they spend working on collaborative, as compared to individual tasks (e.g., Butler & Walton, 2013).

### ***Procedural Information – Test Environment and Warm-Up***

In Germany, children were asked in their day care groups whether they would want to participate in a study. If they agreed, they were led into the testing room by the experimenter without an additional warm-up. On Farm 6, children were recruited in the village whether they would want to participate in the study. If so, they were asked to come to the local school, in which the testing took place. After arrival at school, no further warm-up phase was made use of. In Oshivelo, children were asked during their free-play at the kindergarten yard whether they would want to participate. If so, they were led into the testing room without additional warm-up.

### ***Procedural Information – Instructions during Overimitation Tasks***

Given that conventional, as compared to instrumental instructions have been identified as drivers of children's overimitation (Clegg & Legare, 2016; Keupp et al., 2013), and since the populations I tested differ strongly with regard to the assertiveness with which adults communicate with children, I chose to use a short "Now You!" as a neutral instruction. In the studies by Berl and Hewlett (2015) and Nielsen and Tomaselli (2010) the model stated "Your turn", which may be interpreted as a demand for repeating the sequence, whereas "Now You!" may allow for more variability in children's choice whether to focus on the model's actions or the outcome. In other studies, instructions are often starting with "Now you" before giving participants more detailed instructions to then highlight instrumental or conventional rules (e.g., "Now you can have a go and dax" vs. "Now you can have a go and ring the bells"; Keupp et al. 2013; see also Hoehl et al., 2019). The instructions

were discussed with the Namibian translators and were perceived as culturally appropriate for all three populations.

### ***Procedural Information – Choice of Boxes***

I used mostly similar boxes across both overimitation because I was trying to confront children with boxes of similar difficulty. In both tasks, children should potentially be able to produce overimitative behaviors at similar rates on either box. At the same time, I wanted to avoid that children would either show more or less overimitation in the second phase because they would already know the box from phase 1. I thus decided to use two slightly different boxes (with regards to color, moves on boxes), while keeping significant details constant (e.g., shape, moves that were non-related to the box, such as clapping stick in hand).

### ***Procedural Information – Behavior during Overimitation Tasks***

Direct eye gaze between the experimenter and the participant was avoided during the demonstration phase of the overimitation tasks. Further, facial affect was kept neutral throughout the demonstration phase and the time in which children were given the opportunity to retrieve the reward

### ***Procedural Information – Coding of Reengagement***

Children's behaviors were coded as "active attempts" for reengagement if children did not engage in the activity, but tried to re-establish the collaborative activity with the experimenter through one of the following communicative signals:

- establishing direct eye gaze with the experimenter and following the experimenter's eye gaze

- touching the experimenter with their hands or feet
- creating any form of noise addressed at the experimenter, such as clapping hands or whistling
- talking to the experimenter
- directing gestures or facial expressions at the experimenter

### ***Procedural Information – Materials***

***Overimitation I & II.*** Two transparent polycarbonate boxes (15cm x 15cm x 15cm) were used as study apparatuses. Edges of the boxes were either blue or yellow. Laid on top of the blue box, there was a blue wooden stick (length = 29cm). On the top side of the box, there was a round hole (diameter = 3cm) giving access to an indentation in the box separated of the rest of the box through a transparent barrier. On the left side of the box, there were six polycarbonate sticks in a row forming an area that could be used for producing a rasping sound when rubbing the stick on it. On the front side of the box, there was a small curtain (7cm x 7cm) in front of a second hole (diameter = 3cm) that offered access to a candy (Smarties) hidden in a niche behind it. The yellow box was built such that the rasping area was on top of the box as well as a yellow wooden stick (length = 29cm). Here, the round hole (diameter = 3cm) leading to an isolated chamber was located on the left-hand side of the box. On the front side, a small curtain (7cm x 7cm) covered the niche with the reward. All actions produced with the wooden stick, the rasping area, and the separated area, were causally irrelevant for obtaining the reward. This could simply be done by lifting the curtain by hand or reaching through it.

**Reengagement.** A colored tower (height = 19cm) with eight round, wooden pieces was used for the reengagement paradigm.

### ***Information on Results – Overimitation***

Model-Observing vs. Model-Unobserving (First Trial Only).

Table A1

Population	Condition	
	Model-Observing	Model-Unobserving
Hai  om	3.29 (1.53)	2.64 (1.12)
German	4.46 (1.94)	3.75 (1.85)
Ovambo	3.41 (1.73)	2.12 (1.05)

*Note.* Means (*SD*) of children's overimitation between conditions – data from the first trial

Overimitation – Model-Observing vs. Model-Unobserving.

Table A2

Population	Condition	
	Model-Observing	Model-Unobserving
Hai  om	3.52 (1.48)	3.07 (1.30)
German	4.48 (1.83)	4.12 (1.76)
Ovambo	2.88 (1.67)	2.32 (1.30)

*Note.* Means (*SD*) of children's overimitation between conditions – data from both trials

### ***Information on Results — Reengagement***

Reengagement.

Table A3.

Population	Condition
Hai  om	6.66 (4.53)
German	12.35 (5.69)
Ovambo	7.08 (4.75)

*Note.* Means (*SD*) of children's reengagement behaviors.

### ***Additional Analyses — Note on Coding Systems***

Copying action *iv* was coded as overimitation because this action (lifting the curtain before retrieving the reward) was causally irrelevant in that the reward could be retrieved easier by using the hand instead of the stick for lifting the curtain or by simply reaching through the curtain.

To assess the robustness of our findings, I conducted similar statistical analyses than those reported in the main document, with the only modification of using overimitation scores that did not include action *iv* (range 0 to 6). Regarding our first hypothesis, the main results did not change. I find main effects of condition ( $\chi^2 (1) = 9.07, p = .003$ ), culture ( $\chi^2 (2) = 21.29, p < .001$ ), and age ( $\chi^2 (1) = 33.47, p < .001$ ), but not of sex ( $\chi^2 (1) = 1.38, p = .240$ ). No three- or two-way interaction were found between predictors.

The same picture appears regarding Hypothesis 2: I do not find a link between reengagement behaviors and children's overimitation ( $\chi^2 (1) = 0.76, p = .383$ ),

confirming the results from the manuscript. The effect of culture appears robust ( $\chi^2(2) = 52.70, p < .001$ ).

### ***Additional Analyses — Note on Sample Sizes***

I tested more German children than either of the two Namibian populations. I did so to enable more reliable examinations of individual differences (Hypothesis 2). Since both Namibian samples differed in mean age, testing a larger sample in Germany allowed us to relate this population to both Namibian samples across the age range tested.

In order to analyze whether the difference in sample sizes would impact the conclusions drawn from our data, I ran an additional analysis with the first 40 German participants only. Main results do not change. I still document a main effect of condition ( $\chi^2(1) = 6.37, p = .012$ ), culture ( $\chi^2(2) = 18.89, p < .001$ ), and age ( $\chi^2(1) = 35.31, p < .001$ ), but no effect of sex ( $\chi^2(1) = 0.88, p = .348$ ; Hypothesis 1). Neither do I not find any additional three nor two-way interaction between the predictors.

The same picture appears regarding Hypothesis 2: I do not find a link between reengagement behaviors and children's overimitation ( $\chi^2(1) = 0.54, p = .464$ ), confirming the results from the manuscript. The effect of culture remains the same ( $\chi^2(2) = 46.53, p < .001$ ).



## Publications and Conference Contributions

### *Publications in the Context of this Dissertation*

Stengelin, R., Hepach, R., & Haun, D. B. M. (2019). Being observed increases overimitation in three diverse cultures. *Developmental Psychology*. Advance online publication. <http://dx.doi.org/10.1037/dev0000832>

### *Other Publications*

Stengelin, R., Grueneisen, S., & Tomasello, M. (2018). Why should I trust you? Investigating 5-year-olds' spontaneous mistrust in potential deceivers. *Cognitive Development*, 48, 146-154. <https://doi.org/10.1016/j.cogdev.2018.08.006>

### *Conference Contributions*

Stengelin, R., Grueneisen, S., & Tomasello, M. (2016) *Why should you help me? Investigating 5-year-olds' selective trust in potential deceivers*. Poster presented at the Budapest CEU Conference on Cognitive Development, Budapest, HUN.

Stengelin, R. (2016) *Social motivation and social cognition in young children — A cross-cultural comparison*. Talk at the Young Scientists Workshop: Multidisciplinary Approaches to Socio-Cognitive Development, Muenster, GER.

Stengelin, R., Hepach, R., & Haun, D. B. M (2017) *The development of social motivation across cultures*. Paper presented at PAEPSY, Muenster, GER.

- Stengelin, R., Hepach, R., & Haun, D. B. M. (2018) *The social motivation behind overimitation across cultures*. Poster presented at the Budapest CEU Conference on Cognitive Development, Budapest, HUN.
- Stengelin, R., Hepach, R., & Haun, D. B. M. (2018) *Homo collaborans? A cross-cultural investigation of the causes and consequences of children's collaborative motivations*. Poster presented at the Understanding Social Relationships Conference, Goettingen, GER.
- Stengelin, R., Hepach, R., Haun, D. B. M. (2019) *(Not all) children prefer to collaborate - The impact of social motivation on Theory of Mind-development across cultures*. Poster presented at the Budapest CEU Conference on Cognitive Development, Budapest, HUN.
- Stengelin, R., Hepach, R., Haun, D. B. M. (2019) *Homo collaborans? A cross-cultural investigation of the causes and consequences of young children's collaborative motivations*. Poster presented at the RTG 2070 Conference, Göttingen, GER.
- Stengelin, R. (2019) *Spatial proximity between Hai||om mothers and infants over the course of a day*. Poster presented at the ESLR 2019, Leipzig, GER.
- Stengelin, R., Hepach, R., Haun, D. B. M. (2019) *The ontogeny of mistrust and deception in a Namibian hunter-gatherer community*. Poster presented at PAEPSY, Leipzig, GER.
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## Selbstständigkeitserklärung

Hiermit versichere ich, Roman Daniel Stengelin, geboren am 08.10.1989 in Karlsruhe, dass ich die vorliegende Arbeit eigenständig und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Direkt oder indirekt übernommene Gedanken und Zitate sind in der Arbeit als solche gekennzeichnet.

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Ich habe zu keiner Zeit die Hilfe eines Promotionsberaters in Anspruch genommen. Dritte Personen haben von mir zu keiner Zeit geldwerte Leistungen für Arbeiten erhalten, die im Zusammenhang mit dem Inhalt der vorgelegten Dissertation stehen.

Ich erkläre hiermit zudem, dass ich die vorgelegte Dissertation in dieser oder einer anderen Form nicht anderweitig als Prüfungsarbeit verwendet oder einer anderen Fakultät als Dissertation vorgelegt habe.

Ich habe zu keinem vorherigen Zeitpunkt erfolglose Promotionsversuche an der Universität Leipzig oder einer anderen Hochschule unternommen.

Leipzig, den 03.11.2019

Roman Stengelin